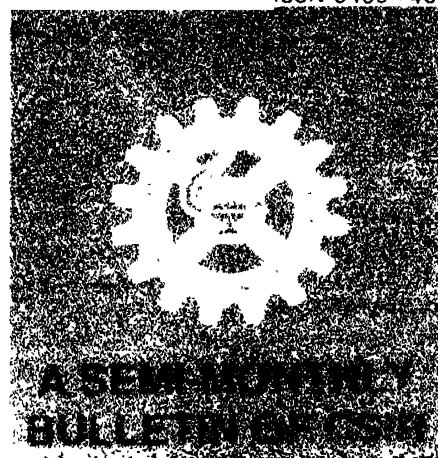
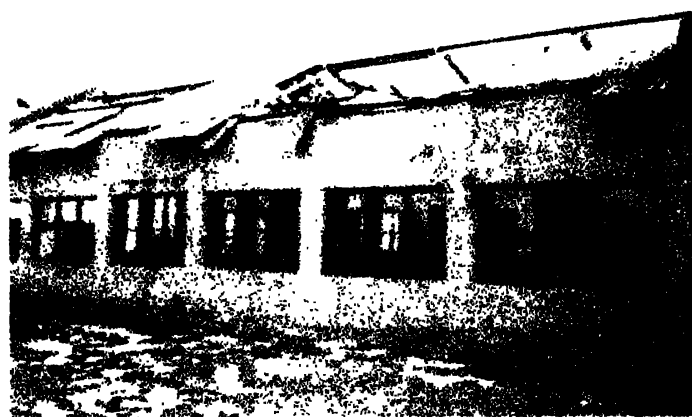


CSIR NEWS



45 NO 1 15 JANUARY 1995



Designing of structures for mitigating damage due to cyclones forms a major area of R & D at the Structural Engineering Research Centre, Madras (p.2). Shown here are: (first row) Failure of sloped roofs at eaves level due to buffeting action of high cyclonic winds, (second row) complete failure of a tiled roof due to uplift force (left) and the remedial measure by providing concrete strips

IN THIS ISSUE

Formed Coke - A substitute for metallurgical grade coal — Partha Sengupta	5	International Congress on Ethnobiology	9	Emerging Trends in Leather Technology and Trade — Semaine du Cuir 1994	12
CFRI helps GHCL combat clinker formation in boiler	7	International Seminar on Science and Technology for Social Development	11	Conference on High Pressure Science & Technology	14
Shallow well hand pump	13				

Engineering of Structures for Mitigating Damage due to Cyclones

It has been the bane of coastal areas in India, more particularly the eastern coastal belt, to experience severe cyclones year after year. When such cyclones hit the coastal areas, they not only cause extensive damage to all types of structures, but also claim scores of human lives.

A large number of rural population in the coastal regions occupy non-engineered traditional thatched and tiled roof dwellings. Even in the urban centres in coastal zones, many people live in residential buildings built with limited construction skills and knowledge not so much as a matter of choice, but as a matter of economic survival. Similarly, many low-rise residential and industrial buildings in the coastal regions are built with light cladding using corrugated asbestos or metal sheets. These buildings may not be vulnerable to non-cyclonic wind speeds recommended in the IS code of practice for wind loads (IS: 875- 1987), but they suffer heavy damage during cyclones.

It is necessary that efforts be made to mitigate damage due to cyclones. And to do this, proper understanding of the nature and occurrence of cyclones and their effects on various structures is essential; such knowledge is rather inadequate at present.

The risk analysis of cyclonic wind speeds carried out by Structural Engineering Research Centre (SERC), Madras, has shown that the sustained wind speeds due to cyclones are far more than the normal wind speeds. Therefore, the dwellings built with light thatched cladding, which are highly permeable to wind, cannot resist the cyclonic wind force. It is preferable to avoid such constructions in the cyclone prone regions.

Failure of even tiled roofs due to uplift near the eaves, ridges and corners has been observed during the cyclone damage surveys of damage caused by cyclones, conducted by the Centre. Many low-rise residential and industrial buildings with light corrugated asbestos sheets have also been found to be damaged due to failure of J-bolt connections and missile impact. Failure of purlins and rafters or trusses due to lack of wind bracing and adequate anchorage into the supporting walls has been also noticed. Even complete collapse of well-engineered constructions have been observed due to inadequate resistance to cyclonic wind force. Some of these failures and the remedial measures are highlighted here:



Roofing nails or hook bolts at every corrugation at ridge eaves and first sheet at gable and, elsewhere, at every other corrugation

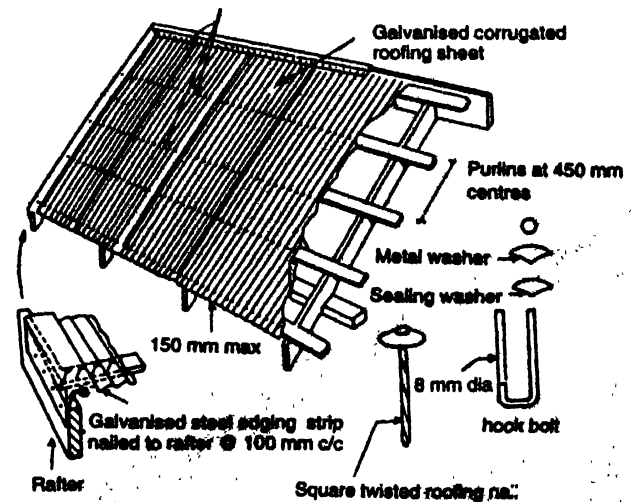
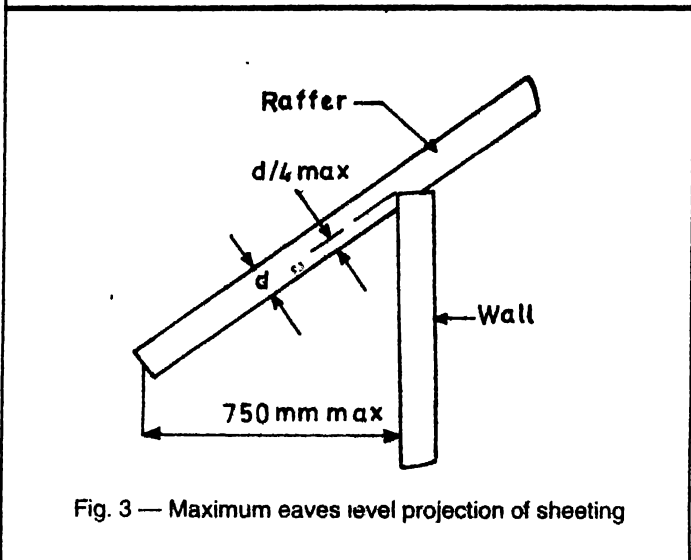
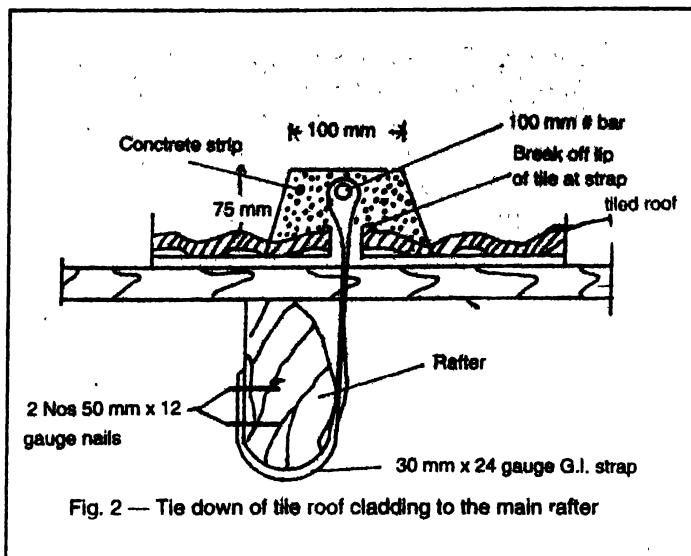


Fig. 1 — Proper fixing of roofing sheets

It is a common observation that cyclones cause failure of roof cladding due to flattening of the open ended hook of J-bolts connecting the AC or GI sheet to the supporting purlins. Failure due to puncturing of the sheet at the top end of the J-bolt is also observed in many cases. Figure 1 shows the failure of roof cladding, and suggested method to improve the connection between cladding and the supporting purlins, by using U-bolts.

Failure of a tiled roof due to uplift force can be avoided by providing concrete strips as shown in Fig. 2 (photo on cover).



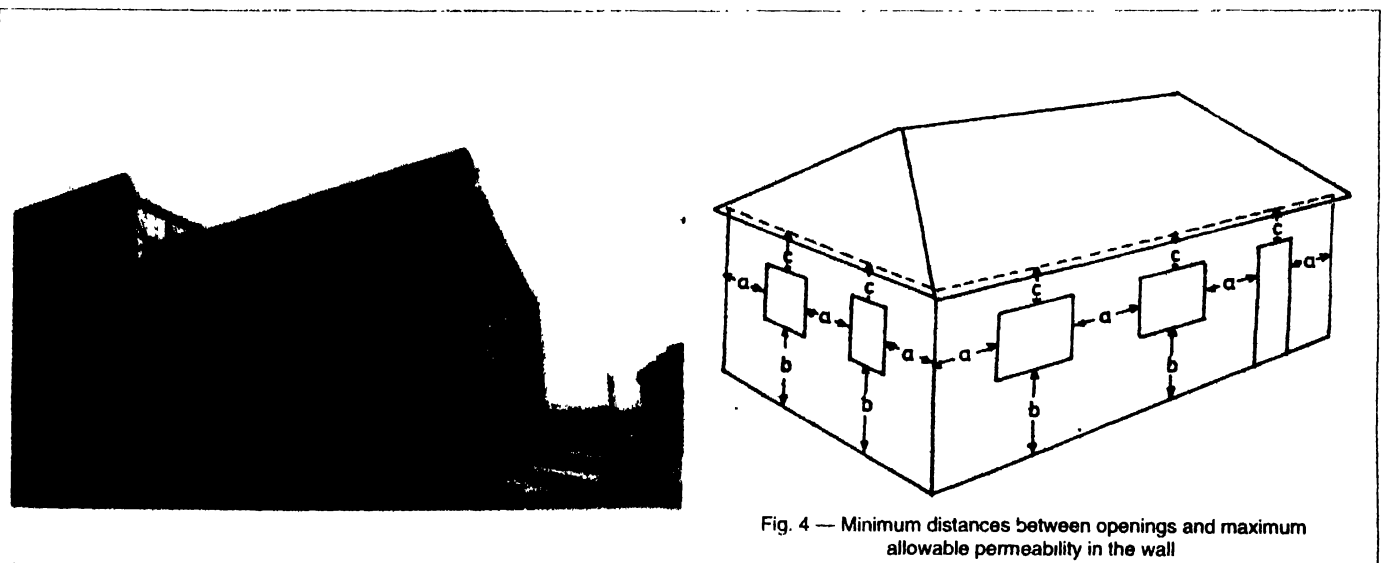
Failure of sloped roofs at eaves level due to buffeting action of high cyclonic winds can be avoided by proper design of eaves: Fig. 3 (photo on cover).

Failure of glass panels of windows near edges of walls due to suction increases permeability, resulting in high internal pressure. This internal pressure combined with the external suction during cyclonic winds leads to failure of cladding in the roof and walls, as shown in the figure. Proper location of these windows in the walls away from edges is suggested: Fig. 4.

Many industrial buildings collapse due to failure of brick masonry walls which have negligible tensile strength. In order to improve their resistance to wind loading, the masonry walls may be strengthened by embedding reinforcement with sufficiently rich mortar cover to prevent corrosion. The figures show complete collapse of the masonry walls, and the suggested remedial measure: Fig. 5.

Many industrial buildings with roof cladding supported on purlins and trusses collapse due to inadequate strength of the superstructure to resist lateral force during cyclones. In some cases, the entire roof with supporting trusses is dislocated due to improper fixing of trusses on the supporting walls. The resistance of the roof supported over trusses can be increased by providing diagonal bracing, at least in the end bays, as shown in the figure. Dislocation of the entire roof can be prevented by fixing the supports of the trusses into walls using concrete bond beams: Fig. 6.

SERC has recently taken up a three-year project on 'Engineering of Structures for Mitigating Damage due to Cyclones', with UNDP assistance to the tune of \$ 1.75 million. The main objective of this project is to improve structural engineering expertise in



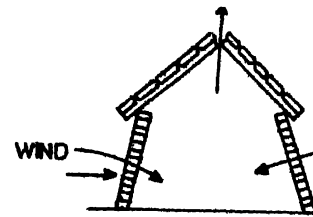


Fig 5 — Provision of
(i) reinforcement in the wall,
(ii) proper connection between
roof and side walls and
(iii) ties in the roof truss

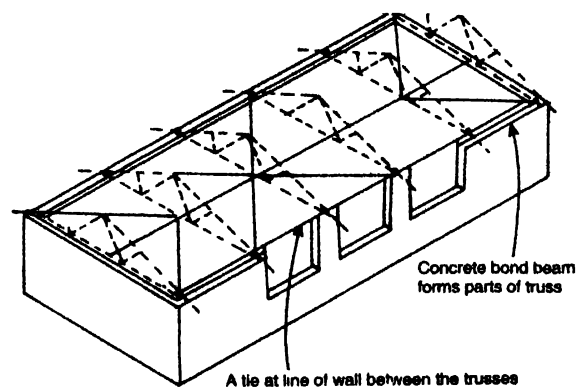
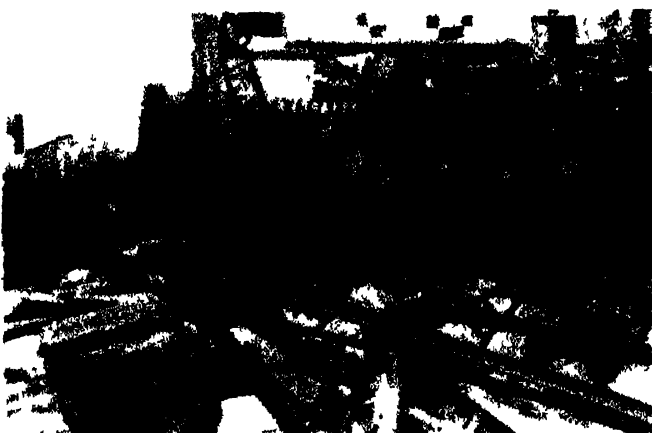
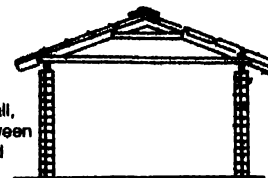
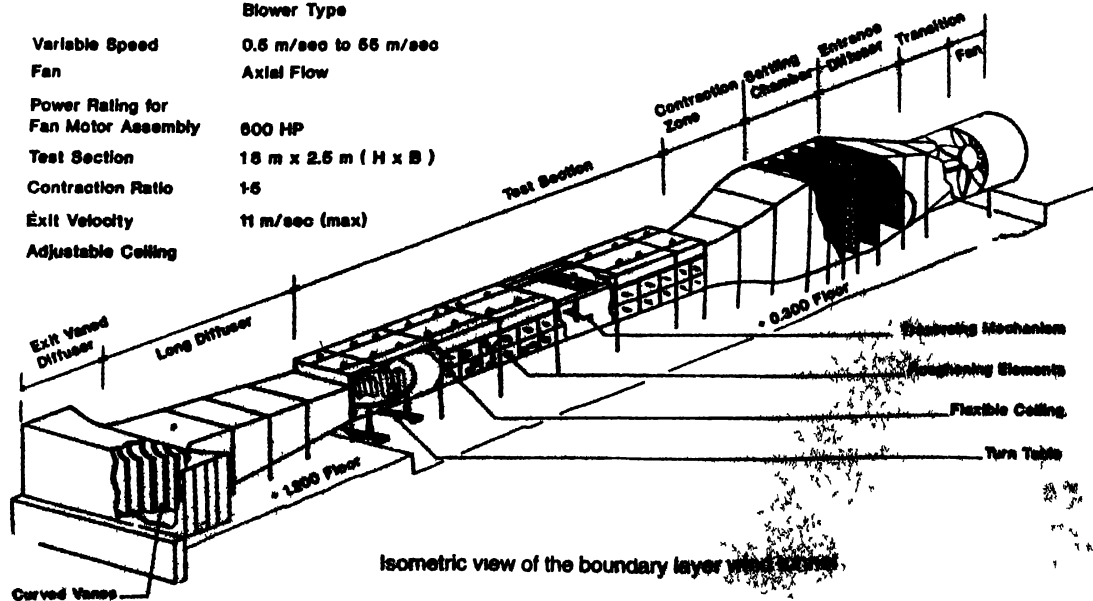


Fig 6 — Provision of wind bracing to improve strength and stability of the roof

TECHNICAL DATA

Type	Open Circuit Blower Type
Variable Speed	0.5 m/sec to 55 m/sec
Fan	Axial Flow
Power Rating for Fan Motor Assembly	600 HP
Test Section	18 m x 2.5 m (H x B)
Contraction Ratio	1:5
Exit Velocity	11 m/sec (max)
Adjustable Ceiling	



Isometric view of the boundary layer wind tunnel

conducting field experiments on prototype structures and laboratory tests on structural models in wind tunnels to assess the wind pressure distribution and dynamic response of structures subjected to cyclonic and other extreme winds, and thus mitigate damage to structures due to the action of cyclones.

Details regarding the expertise available at SERC in this area can be had from: Director, Structural Engineering Research Centre, CSIR Campus, Taramani, Madras 600 113, Phone: 2352175/2351605, Gram: SERCENTER, Telex: 041:8906 CSIR IN, 041- 8798 TTRS IN, Fax: 91:(044):2350508. □

Formed Coke - A substitute for metallurgical grade coal⁺

PARTHA SENGUPTA

Technology Utilization Cell, Central Fuel Research Institute, Dhanbad

The fuel used in metallurgical and many other industrial operations is mostly coke which is produced by high temperature carbonization of coking coal in by-product (B.P.) or beehive (B.H) coke ovens. For the production of quality hard coke for metallurgical industries, the availability of good quality coking coals is one of the basic requirements. But the good quality coking coals are not so abundantly available. In fact, shortage of these coals has been a matter of great concern all over the world in the recent years as the demand for these has been steadily going up to meet the ever increasing requirement of coke for iron and steel industry. Besides the iron and steel industry, hard coke is used in foundries including re-rolling mills, lime kilns, producer gas plants, pit furnaces, etc. For foundries, the coke needs to be quite dense having low porosity and high Micum Index.

In India, the reserves of prime coking coal and medium coking coal are estimated to be around 27302.23 million tonnes; the amount of former being just 5300 million tonnes! On the other hand, the reserves of non-coking coals are estimated to be about 168727.65 million tonnes.

Moreover, the ash content of the Indian coking coals is high, and on washing, these coals give low yield of clean coal owing to their inferior cleaning characteristics.

The total requirement of the metallurgical grade coke in the country is about 15 million tonnes/annum, out of which about 3 million tonnes are needed for the foundries. As the indigenous production of low-ash good quality coal is not sufficient, about 7 million tonnes of coal are imported

every year for blending these with the indigenous coals for metallurgical coke making. Coke is also being imported to meet the demand of low-ash coke.

CFRI Technology for producing Formed Coke - A substitute for metallurgical coke

The Central Fuel Research Institute (CFRI), Dhanbad, has developed a technology for producing formed coke as an alternative

Table-1
Indian Standards of Industrial Coke

	Blast furnace grade			Foundry coke		
	Grade 1	Grade 2	Spl.	Gr.1	Gr.2	Gr.3
Ash % (max.)	22.0	25.0	20.0	25.0	30.0	35.0
Moisture % (max.)	4.0	4.0	4.0	4.0	4.0	4.0
Vol. Matter % (max.)	1.5	1.5	2.0	2.0	2.0	2.0
Sulphur % (max.)	0.7	0.7	0.7	0.7	0.7	0.7
Phosphorus %	0.25	0.25	0.15	0.3	0.3	0.3
Shatter Index (min.)			90	85.0	80.0	75.0
(Over 50 mm)						
Over 12.5 mm	-	-	96.0	95.0	94.0	92.0
Micum Index (min)						
M ₄₀	78.0	76.0	-	-	-	-
M ₁₀	10.0	12.0	-	-	-	-
Porosity %	38-45	38-45	35-45	35-45	35-45	35-45

* Lecture delivered at the workshop on Modernisation & Acquisition of Technologies for Small-scale Industries organized by NSIC, CSIR and APCTT at Calcutta on 28-29 October 1994.

Table-2
Properties of Formed Coke

	From coke breeze having ash content 22 to 25%		From non-coking coal
Shape	Ovoid	Ovoid	Ovoid
Size (mm)	63x50x38	80x60x40	63x50x38
Wt per piece (g)	73-74	120-122	75-76
(iv) App. density (g/c.c)	1.20	1.3	1.17
Point crushing strength (kg)	250	220	250-280
Shatter index on 38 mm	90-95	99.0	93-95
Prox. analysis (as received basis)			
M %	2.9	1.8	4-5
Ash %	24.9	26.2	21-22
V.M. %	5.1	6.9	7-8
F.C. %	67.1	65.1	67-68
Reactivity towards CO ₂	122-124	-	136
Porosity	33-34	34	38-42

The weight of 115x75x55 mm ovoid formed coke is 290 g. It has a point crushing strength of 150 kg. Formed coke containing lower ash percentage can be made from the coke breeze available from coke made from imported coal. This formed coke shall have: ash 18% (max), V.M. - 5% (max.), fixed carbon - 76. 80, M₄₀ - >90 and M₁₀ - <10.

fuel for foundries/mini steel plants: The raw materials for making formed coke can be: Non-coking coals which are available in abundance, coke breeze from the coke ovens of steel plants, and undersized coke/char from low/medium temperature carbonization plants.

The CFRI process consists of: (a) converting coal into coke/char, (b) crushing of coke/char or coke breeze into optimum fineness, (c) mixing of char/coke/coke breeze fines with some organic binder, (d) briquetting the mixture after steaming, and (e) oxythermal treatment of the briquettes under controlled conditions.

Formed coke thus produced has certain advantages in the low shaft furnaces and foundries in comparison to conventional coke. Firstly, the uniform size and shape

of the coke permits fuller utilization without rejection and provides better air permeability through the bed. Secondly, lime stone/dolomite can be incorporated during briquetting for efficient utilization of flux. And, thirdly, because of the low-ash content, it gives higher thermal efficiency and requires lesser amount of flux.

In the case of formed coke produced from H.T. coke breeze and asphalt binder, the product is found to contain 97% of unaltered breeze and rest 3% remains as the remnant of the binder converted to hardened thermosetting resin. The product thus possesses the chemical properties almost the same as the coke breeze or the parent metallurgical coke. But, by imparting the same size and shape and consolidation, the behaviour of the product inside the foundry hearth is much improved. The higher per-

centage of volatile matter (VM) content in formed coke does not hamper the hearth operation or productivity as the VM escapes gradually before it reaches the reaction zone, due to the high temperature of the hearth. A very high order of strength of formed coke can be achieved by allowing sufficient time and controlling operational parameters, during oxythermal treatment of raw briquettes. During reaction of binder with oxygen, heat is produced and, therefore, careful operation is needed to quench the excess heat generated to prevent the undue distillation of binder and combustion leading to fire.

Industrial trials have been conducted with the formed coke produced in the pilot plants of CFRI. Indian non-coking coals are generally characterized by low phosphorus content, and formed coke produced from suitably selected non-coking coals can be used for making high-value products like low-phosphorus pig iron and low phosphorus ferro alloys, which could further be converted to S.G. iron, an imported engineering material used in automobile industry and defence production. As a joint programme of Research & Development Centre for Iron & Steel (RDCIS, SAIL), CFRI and Kalinga Iron Works, Barbil, about 250 tonnes of pig iron with an average

Table-3
Comparison of quality of formed coke with BP hard coke

Parameter	BP hard coke	Formed coke
Ash %	28-30	28-30
Moisture %	7-8	1-2
Volatile matter %	1.5-2.5	5.5-7.5
Porosity %	around 30	around 30
Size (mm)	100 and above	115 x 70 x 50 & 63 x 50 x 30

phosphorus content of 0.164% (Indian iron making conditions allow production of pig iron with phosphorus 0.25-0.3%) has been produced in the blast furnace of KIW, using about 100 tonnes of formed coke produced at CFRI utilizing the non-coking coals of Chirimiri and Churcha in Madhya Pradesh. Trials with formed coke have also been conducted at Kulti and Burnpur Works of IISCO and results have been found to be very satisfactory. Formed coke may also be used as split charge and an increase in productivity has been reported.

Nowadays, low-ash low-phosphorus coals and coke are imported and, therefore, availability of low-phosphorus low-ash coke breeze is no problem. This coke breeze can be used to produce formed coke for blast furnaces/cupolas to produce good quality iron and steel.

Due to acute shortage of proper quality of hard coke for metallurgical and industrial uses, there appears to be a great scope for the industries for the production and use of formed coke. The minimum economic capacity of a formed coke plant based on coke breeze and asphalt binder is 25 tonnes/day and the investment for such a plant is calculated to be around Rs 60-70 lakh. The ex-factory cost of product on current cost structure is competitive with the conventional coke. □

CFRI helps GHCL combat clinker formation in boilers

Clinker formation results in more boiler outage hours and may even result in failure of boiler tube leading to serious accidents. The Gujarat Heavy Chemicals Ltd (GHCL), Sutrapada,

Veraval, who was facing the problem of clinker formation in its mechanical grate spreader stocker

-fired type boilers using Panandiro lignite as fuel, approached the Central Fuel Research Institute (CFRI), Dhanbad, to look into the problem.

After conducting studies, both in the plant of GHCL and in the lab, CFRI recommended certain measures for the abatement of clinker formation. The measures recommended relate to efficient combustion of lignite, use of doping agents, etc. With the implementation of these recommendations, GHCL is likely to overcome the problem of clinker formation. □

Shallow Well Hand Pump

The Mechanical Engineering Research & Development Organisation (MERADO), Madras, has designed a shallow well hand pump suitable for operation in areas having water level up to seven metres. The pump components have been made from better material for low wear and tear, less friction and negligible corrosion. The components have been standardized so as to attain interchangeability of the critical components. The use of



Shallow well hand pump developed by MERADO

better quality material and modern manufacturing technique have resulted in a reliable, light-weight, better quality pump requiring low operational effort for pumping the water for drinking purposes.

Specifications

Diam. of cylinder	80 mm
Stroke length	100±5 mm
Weight of the pump	20 kg (appx)
Rate of discharge	18 litres/40 strokes

□

Efficient Generation of Modules Over a Ring

Dr N. Mohan Kumar's Bhatnagar Prize-winning Work

The major part of studies made by Dr N. Mohan Kumar of Tata Institute of Fundamental Research, Bombay, who has been awarded the Shanti Swarup Bhatnagar Prize in Mathematical Sciences for the year 1994, deals with efficient generations of modules over a ring. The problems in this area are inextricably linked to the study of vector bundles. He has settled some well-known conjectures in this area, e.g. the Eisenbud-Evans conjecture and Forster's conjecture. He has also classified certain singular points known as rational



double points on rational surfaces which was done algebraically for the first time. With M.P. Murthy,

he has shown that vector bundles over affine 3-folds is completely characterized by their chern classes. These techniques have also influenced him in obtaining certain invariants (via chern classes), helping in settling a question of Suslin, by constructing vector bundles which are topologically trivial but not algebraically trivial. His recent studies relate to deformations of vector bundles on 3-space, where he has shown that certain intuitively obvious 'facts' are not necessarily true. □

Health study of pesticide sprayers

The Industrial Toxicology Research Centre, Lucknow, in an attempt to find the socio-environmental health status of workers engaged in pesticide spraying, has made a cross-sectional survey of 489 male subjects in the age group of 15 to 65 years engaged in pesticide spraying in mango orchards, with 208 control subjects. These workers were exposed to a number of organochlorine and organophosphorus pesticides while spraying these for crop protection. High illiteracy rate (49.5%), poverty (PCI less than Rs 100 per month, 52.2%), poor housing (mud houses, 66.7%) and unsafe water supply (78.6%) were prevalent. The study showed the prevalence of 36.5% and 41.5% respiratory impairment in the exposed workers and in the control subjects, respectively. The most common pulmonary impairment among the exposed subjects (18.8%) and controls (16.9%) was of the restrictive type, followed by mixed ventilatory defect. Bronchial obstruction affected 2.5 and 3.7% of the exposed and control populations, respectively. The high respiratory morbidity may be attributed to high prevalence of smoking and

prolonged inhalation of organic dusts during farming operations associated with illiteracy and poor socio-economic status. Gastrointestinal disorders were related to poor hygienic conditions and consumption of contaminated water. The symptoms pertaining to central nervous system were found to be associated with exposure to pesticides. The prevalence of polyneuropathy was found to be significantly higher among farm workers than in the unexposed subjects.

Values of total DDT, total BHC, endosulfan and aldrin levels in air of orchards were 0.076-528.3, 14.0-2897.0, 0.0-216.2 and 1.0-240.4 ng/m³ respectively which were significantly higher ($p < 0.05$) than in ambient air samples. The levels of most of the pesticides in sera of exposed workers were found to be higher than those reported in the literature and the control values. Pesticide levels in the serum of exposed workers were in the order: BHC (15.94 ng/ml) < endosulfan (5.64 ng/ml) < DDT (4.4 ng/ml) < aldrin (1.37 ng/ml). Such high levels of BHC are possibly because of extensive use of BHC on mango trees.

Among the isomers of BHC, level of β -isomer was found to be more than α and γ -isomers. Total BHC level in sera of exposed workers showed a gradual increase with exposure period. Furthermore, the rate of accumulation of DDT in workers, exposed for twenty years or more, was found equal to the rate of elimination of DDT through urine; whereas workers exposed for less than 20 years showed higher values of DDT in sera. From the study it is suggested that existing social conditions and exposure to pesticides are responsible for high prevalence of different morbidities in workers engaged in pesticides spraying. This calls for stringent preventive and protective measures to safeguard the health of these persons. □

CSIR participates in IITF, TECHMART and IETCF'94

CSIR participated in the following three exhibitions held in New Delhi in November 1994: India International Trade Fair '94, TECHMART



Dr S.K. Joshi, Director General, CSIR, explaining the R&D work on *Hansa* and *Saras* to the Finance Minister Dr Man Mohan Singh, at TECHMART'94

'94 and India International Education Training & Career Fair '94.

The India International Trade Fair held during 14-27 November 1994 under the aegis of India Trade Promotion Organisation, at Pragati Maidan, New Delhi, was inaugurated by the Prime Minister Shri P.V.Narasimha Rao. The exhibits displayed in the CSIR stall were from CRRI, NEERI, CFTRI, CBRI, CLRI, CIMAP, CGCRI, CDRI, CEERI, SERC, CBT, CSIO and IIP. The visitors to the stall included senior executives from government, public sector and private sector, students, entrepreneurs, businessmen and representatives of the media. The visitors showed keen interest in the exhibits. The technologies displayed were given prominent coverage at prime time by Doordarshan and All India Radio.

TECHMART '94, organized by the National Small Industries Corporation at Pragati Maidan, New Delhi, during 14-27 November 1994 was inaugurated by the Finance Minister Dr Manmohan Singh, who made it a point to spend a few minutes with Dr S.K. Joshi, Director General, CSIR, to discuss the technologies developed by CSIR. He evinced keen interest in the aircraft HANSA & SARAS of NAL, Bangalore. The other VIPs who visited the CSIR stall include Shri M. Arunachalam, Minister of State for Industries, Government of India and Shri H.S. Wali, Minister of Industries, National Capital Territory. The laboratories which participated in this fair are CBRI, CGCRI, IMTECH, CLRI, CMERI, CSIO, CEERI, NEERI & NAL.

The India International Education Training & Career Fair '94, was organized by The Management Group, New Delhi, at the Holiday Inn, during 24-27 November 1994. The participants to the fair included six international and 13 national organizations. The main aim

of CSIR participation in this fair was to apprise the students about activities of the Human Resources Development Group of CSIR. The visitors to the stall comprised

young students and their parents. The fair proved to be an effective avenue for dissemination of CSIR activities in the field of Human Resources Development. □

International Congress on Ethnobiology

The Fourth International Congress on Ethnobiology was organized under the aegis of International Society of Ethnobotanists by the Society of Ethnobotanists at the National Botanical Research Institute (NBRI), Lucknow, during 17-21 November 1994. Co-sponsored by NBRI and the Central Drug Research Institute (CDRI), Lucknow, and supported by the Department of Environment, Government of India; Healing Forest Conservancy (USA); Ford Foundation (India); WWF-India; IIBPGRI (Delhi Office); Earthwatch (USA); Tropical Botanical Research Institute (Thiruvanthapuram, India); Hindustan Levers Ltd; Ranbaxy Labs; INSA and ICMR, New Delhi, the congress was attended by 200 Indian and 80 foreign scientists.

In his welcome address, Dr P.V. Sane, Director, NBRI and Chair-

man of the National Organizing Committee, said that ethnobotany has been an important area of research at NBRI and expressed the hope that the Congress would help in creating greater enthusiasm about the subject among the Indian biologist.

Prof. M.S. Swaminathan FRS, Chairman, M.S. Swaminathan Research Foundation, Madras and Director General, International Rice Research Institute, Manila, was the Chief Guest on the occasion. In his address, Prof. Swaminathan emphasized the importance of ethnobiology in discovery of new herbal medicines and food. Adding a word of caution about the severe competition likely to result out of the intellectual property right (IPR), he emphasized the need for protecting the interests of the local people, who have



Dr S.K. Jain welcoming the chief guest Prof. M.S. Swaminathan at the International Congress on Ethnobiology. Others seen on dais (from left) are: Dr Darrell Posey, Dr P.V. Sane and Dr A.B. Cunningham

immense knowledge of natural resources. Dr Swaminathan also highlighted the Indian researches utilizing indigenous knowledge for welfare of humanity.

Dr A.B. Cunningham, President, International Society of Ethnobiology in his presidential lecture pointed out the crucial relationship between conservation, development and people, and the role of International Society of Ethnobiologists.

Dr S.K. Jain, the renowned ethnobotanist and Chairman of the organizing committee, informed that invitation for the Congress was extended in 1990 during the second Congress held at Kunming, China. The main aim of the Congress was to highlight the entire gamut of relationship of plants and animals with the human welfare, Dr Jain said.

The technical programme was divided into 25 sessions, which included eight symposia. The themes ranged from folk concepts of natural phenomena and classification to indigenous knowledge about curing diseases, wild foods, conservation of biodiversity and Intellectual Property Right. Research work involving international linkages was also described.

The programme included four distinguished lectures by Dr Darrell Posey (UK), Dr Nitya Nand (CDRI, Lucknow), Prof. Elois Berlin (USA), and Dr R.K. Arora (IBPGRI, New Delhi) and four Medal Award Lectures by Prof. Brent Berlin (USA), Prof. Pei Shengji (China), Prof. R.I. Ford (USA) and Dr R.R.Rao (NBRI, Lucknow). Dr S.K. Jain, delivered a keynote address in which he reviewed landmarks in evolution of ethnobiology in India.

Dr Nitya Nand in his distinguished lecture recalled the philosophy of good health explained in the two famous ancient Indian

works — *Charak Samhita* and *Sushruta Samhita* and their direct relevance to the mankind today. Citing the example of Guggul, he said that treasures of drugs mentioned in these works are of great demand even today. He also explained the drug delivery system in Ayurvedic practice, which has paved the way for modern scientific drug research.

Dr Posey stressed on need for protecting the Intellectual Property Right of tribals, who are the treasure of indigenous knowledge. He viewed the role of present ethnobiologists as valiant, warriors, victims & villains and stated that it is for Ethnobiologists to prove themselves as successful warriors.

In his lecture, Dr Arora pointed out that the tribals have provided information on a wide variety of plant genetic resources and land races of several of our cultivated plants. He said that the areas of native plant diversity are located in the developing world, and in India, specially in the north-east region, an enormous genetic diversity exists in land races of different agricultural plants. These areas are also the seats of domestication of native food and other useful plants, such as *Moghania vestita*, a minor millet grown and domesticated by Khasi and Jaintia Hills of Meghalaya.

Dr (Mrs) Berlin spoke on 'Ethnobotany and Human Health', giving the subject an applied value. She emphasized the need for bringing out an Ethnobotanical directory in local languages.

Speaking on this occasion, the noted environmentalist and the *Chipko Movement* leader, Shri Sunder Lal Bauguna stated that it was India which gave origin to the science of self knowledge (*atma gyana*). Stating that science combined with self knowledge invokes peace, he urged all scientists to treat for-

ests as their laboratories and villages/tribals as their wisdom. Otherwise, in the ultimate struggle between man and nature, if man happens to win, it would be the dooms day for humanity, he cautioned.

Delivering the Janki Ammal Medal Lecture, Dr Brent Berlin emphasized the need to train the ethnobiologists for facing the challenges of 21st century. He also stressed the need for an International consortium for ethnobiology.

Prof. R.I. Ford of Michigan University, the second recipient of the Janki Ammal Medal for 1994, traced the chronological history and development of ethnobiology. Admiring the work of Indian scientists, Prof. Ford said that India has maximum number of ethnobotanists in the world. He called for a more systematic research in ethnobiology in universities, and also for coordination with other disciplines, materially, legally as well as spiritually.

The Harshbarger Medal winner of 1994, Dr R.R.Rao, Scientist, NBRI, gave a detailed account of the nature and status of 'Ethnobotany of Nagas of Nagaland in North-east India'.

The second Harshberger Medal Lecture was delivered by Dr Pei Shengji of China. He pointed out that the enormous ethnobiological resources in the Himalayas and their inaccessibility owing to several factors. He also cautioned about the rapid decline in the biological resources.

The following books were released during the Congress: *Cross-cultural Ethnobotany of Northeast India* by Dr Arvind Saklani & Dr S.K.Jain (India), *Ethnobotany* by Gary Martin, Paris (France); and *Ethnobotany of Rajasthan* by Dr Prabhakar Joshi (India). □

International Seminar on Science and Technology for Social Development

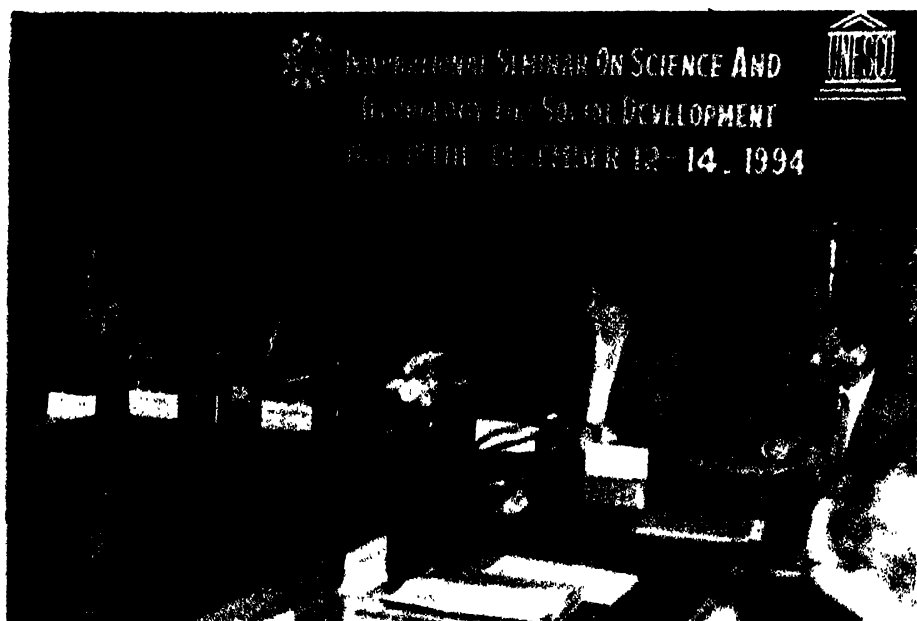
The United Nation's World Summit for Social Development (WSDS) is scheduled to be held during 6-12 March 1995, in Copenhagen, Denmark. Preparatory to this Social Summit, a three-day international seminar on Science and Technology for Social Development was jointly organized by UNESCO and the National Institute of Science, Technology and Development Studies (NISTADS) in New Delhi from 12 to 14 December 1994. It was attended by participants from Brazil, People's Republic of China, Thailand, France, Malaysia, United States, Kenya, and India. Besides, there were observers from FAO, ILO, and Commonwealth Secretariat, UK.

Welcoming the delegates, Dr John Kingston, Director of UNESCO Regional Office for Science and Technology for South and Central Asia, New Delhi, said that time has come to pay attention to the development dimension of science and technology.

Referring to the forthcoming Social Summit, Dr (Mrs) Francine Fournier, Assistant Director General for Social and Human Sciences, said that this is for the first time that the international community will be addressing the issue of social development at the summit level. It will identify new challenges that face the humanity as we usher into the twenty-first century. She emphasized the need to document how science and technology have influenced different social structures and cultures in the past, and how the latter have reacted to the introduction of new inventions and innovations. "We must find ways to exercise social control over science and technology. The question of ethics, of social desirability, of management of social and cultural change that were given a back seat in the past are now brought to the fore", she added.

Welcoming the participants on behalf of the Council of Scientific & Industrial Research, the CSIR Di-

rector General Dr S.K. Joshi said that scientific and technological research has a vital bearing on its social, economic, political and cultural environments in which it is carried out. The growth and development of science and technology have tended to outpace developments in social sciences. One consequence of this is the inadequacy of knowledge available on the management of scientific and technological enterprises. When we look at the applications of science and technology, we are overwhelmed by its contributions in the spheres of health, food, new materials, communication and industrial development. Issues like growing social inequalities, erosion of cultural values, environmental degradation and social disintegration tend to get the back seat. At the ground level, R&D is pursued and managed in response to market demand. The efficacy of R&D response to market depends largely on the awareness and commitment of the scientific community to social goals and partly to the political support to achieve these goals. The sphere of social demands has yet to be accepted as part of the total market spectrum. He also drew attention to the reality of globalization, compelling everyone to work in competitive mode to respond to market demands. He opined that development of technology for sustainable social development is an important area, in pursuit of which all countries of the world must cooperate. He stressed the need for giving priority to areas like biotechnology, microelectronics, information technology and new materials for promoting employment generation and sustainable social development. To tap the potential of new areas for sustainable development, the developing countries will have to depend on their own R&D capabilities, he added.



Dr John V. Kingston welcoming the delegates of International Seminar on Science and Technology for Social Development. Others seen on the dais (from left) are: Dr S.K. Joshi, Shri Ram Niwas Mirdha, Dr (Mrs) Francine Fournier and Dr Ashok Jain

In his inaugural address, Shri Ram Niwas Mirdha, Member Parliament and Member of the Executive Board of UNESCO, talked about the need to bring science and technology closer to the people. He pleaded for rejection of the 'sanitized' concept of welfare society and its replacement by *humane* development. He said, find out how science and technology can help in development and not in dominating others. Scientists tend to underestimate traditional knowledge and wisdom. The local know-how and traditional knowledge have sustained societies for centuries, but these are overlooked by the arrogance of modern knowledge". He underlined the role of NGOs and called upon them to popularize science on the one hand, and demystify science itself, on the other. It is only through this process that scientific temper can be created.

Dr Ashok Jain, Director, NIS-TADS, proposed a vote of thanks. He visualised the seminar providing an opportunity for meeting of minds for a critical look at the interface of science, technology and social development. He said that a relook at the various developmental experiences is expected to provide an agenda for the orientation of science and technology capabilities towards a more purposeful social order.

The discussion at the seminar focused on the problems of decentralized industrialization, sustainable urban development strategies, the emerging need for Second Green Revolution, and the question of human resource development in the context of new demands and revolutionary changes brought about by technological advances. References were made to the efforts made for developing technologies related to land, water and resource-saving and those that generate employment in both agricultural and non-agricul-

tural rural sectors. It was emphasized that considerable scope exists for improving the living conditions and the environmental situation in the cities by expanding labour-intensive activities such as waste recycling, energy and water conservation, better maintenance of existing infrastructures, equipment and housing as well as investment in low-cost housing.

Science and technology constitute an important input into socially equitable development strategies. But to be successfully applied these require comprehensive and consistent policy pack-

ages. In particular the grass-root education to disseminate scientific culture as well as new forms of partnership between households, communities, citizen movements, public authorities and enterprises. It was concluded that significant experience in various countries exists for pluralistic new development patterns to build on biological as well as cultural diversity. S&T efforts directed to such a development will mitigate the negative effects of globalization processes and will contribute to the major issues before the Social Summit. □

Emerging Trends in Leather Technology and Trade — Semaine du Cuir 1994

Hides and skins, leather and leather products are widely traded global commodities. And Seminar du Cuir, the oldest and largest leather fair in the world held every year in Paris, offers an excellent avenue to know about the current trends in leather technology and trade. The fair held in 1994 was the 51st in the series. It had the participation of about 2300 exhibitors from 65 countries. The impressions of the team consisting of Dr K.V. Raghavan, Director; Dr T.Ramasami, Chemist and Leather Technologist; Dr K.S.V. Srinivasan, Polymer Chemist; Dr Rajamani, Environmental Technologist; Shri D. Chandramouli, Leather Economist; and Shri Md. Sadiq, Footwear Scientist, Central Leather Research Institute (CLRI), Madras, which visited this fair, are summed up here:

Looking from the nature of participation over the years it appears that Paris Fair is fast becoming a specialized fair for leather tanning and finishing sectors. About 75%

of the exhibitors in the 1994 fair related to leather processing industry in the form of leathers, chemicals and machinery. While the leather garments and leather goods accounted for approximately 15% of the items displayed, footwear hardly found a place. The impact of the specialized product fairs was clearly visible on the fair.

The current focus of India is on the export of value-added products. And the Paris fair provides a good opportunity to the Indian product sectors to source their requirement of leathers; and to the tanning sector to source the raw materials and equipment.

Emerging Trends in Leather Technology

Hide-based leathers continued to dominate the fair with a variety of uses. Oil pull up, Nubuck, upholstery, nappa, corrected grain upper with black and brown colour were widely displayed. The emerging finishing techniques appear to be



A stall at the Paris Leather Fair

more inclined towards the natural look rather than the glossy one. Suede-based leathers were prominently seen (~ 30%) and thus these appear to be back in the trade. An increasing emphasis was noticed on the improvement of low-grade leathers. The innovative split finishing techniques came into vogue with foam, transfer foils, transfer coating, speciality chemicals, etc. With a wide variety of colours, metal foils have made a significant entry into the leather sector. These are mostly used on ovine leathers. The Europeans, particularly Italians, put up an excellent display of upgraded leathers.

Several new techniques have been developed to upgrade the inferior quality leathers. These include foam system, transfer foils, embossing and plating.

Styrene-maleic anhydride copolymer from Atochem has been claimed to be a good retanning agent over acrylic. It also gives better chrome exhaustion.

As many as 40 ranges of shoe auxiliaries were exhibited. Neoprene and polychloroprene ap-

peared to be the most widely used adhesives.

'Stoetchgard Leather Protector' was shown to be a unique treatment designed to keep the leather look new and increase its shelf life by providing lasting protection against stains. It guards against water and oily liquids and retains the luxurious look longer.

Emerging Trends in Leather Machines -- Electronic Controls and Automation

This is an area where the European domination continues to reign. As usual, large wide width machines were on display. These are highly suitable for the large-scale hide-based tanneries in Europe and America. Recent trend has been the addition of electronic controls and automation devices. Microprocessor-controlled systems are in the offing. A new feature of this year's fair was the display of reconditioned machines, keeping in view the demand from some of the developing countries in Asia and Africa.

The other important developments in the machines and equipment are:

- Coating technologies for leather finishing and roller coating devices
- Reduced length dryers/conveyors for spray systems
- Splitting machines for closer tolerance
- Punching machines for closer tolerance
- Punching machines to get hand-woven effect
- Facilities for chrome recovery; screens and filters and effluent treatment systems

Though the big tanneries in India are able to import the sophisticated machines used in the leather processing, a large number of small tanneries are not able to do so because of the high cost of these machines. Another factor is the non-availability of these machines at varying capacities, particularly suitable for small-scale operations. Probably this is one of the reasons that many small-scale tanners prefer to operate in clusters/complexes where job work facilities are available for machine operations.

Emerging Trends in the Global Trade

The production of raw materials and consumption of products more or less appeared to follow the same pattern globally, but the processing/manufacturing activities have been constantly shifting from one region to another. These shifts have contributed significantly to the growth of the trade in the leather sector. The recent trends in the leather trade as observed in the fair are:

There are indications of resurgence of the tanning activity in USA. Leather Industries of America (LIA) had put up a collective show with specialization in waterproof,

stain-resistant, machine washable/dryable leathers. They are trying to promote weather tough leathers and shoes. Another innovative effort is the commercial and regulated farming of alligators whose skins/products fetch fancy prices.

Chinese participation in the fair was limited and confined to the display of leather goods of a few state enterprises. But of late, China is emerging as a leading exporter of leather products. There is a huge foreign investment and entry of foreign brand names into China.

There has been phenomenal rise in the global trade of leather garments during the past 10 years. Turkey is emerging as a leading player in this area. Of the \$ 600 million worth of leather sector exports from Turkey, leather garments account for 80%. While the variety and price of garments (quality garments in the price range of \$70 to 200 per piece) is its basic strength, collective image building through fashion shows is the other significant marketing effort to emerge as a leader in Europe.

Though African participation was not significant, there were enough indications of the potential that the region has. Ethiopia, Nigeria, Botswana, Burkina Faso participated in a limited way with the help of UNIDO. There was a good display of raw, semi-tanned and finished leathers by these countries. European support and management of leather sector in some of the African countries was also visible. South Africa is likely to play a major role from this region in future. There was a large participation from Pakistan, focussing attention on leather garments and leathers. Leather garments appeared to be high on its export agenda. Prices of garments were more attractive in comparison to Turkey and India, and it appears to be making every effort to make a

mark in the global trade, and is perceived as a major competitor of India.

A simple but beautiful show was put up by the Bangladesh Export Promotion Bureau. It presented a variety of leathers at competitive prices. It appears that it has consolidated strength in leather processing.

Eco-labelling — Environmental Aspects

The recognition of environmental protection appears to have well gone into the whole spectrum of leather industry. For the last few years, the concepts like 'eco-friendly', 'environment - friendly', 'natural', 'free from chrome', etc. are being widely used, rather claimed, by the chemical manufacturers, tanners and even the product manufacturers. This trend was very well reflected in the Paris Fair. However, in the absence of universally accepted specifications for eco-labelling, it has become a

paradise for false claims. The recent meeting of UNIDO to prepare ground rules for eco-labelling is a welcome feature in this context. □

Conference on High Pressure Science & Technology

During the XIII AIRAPT International Conference held at Bangalore in October 1991, the Indian researchers in high pressure science and technology decided to meet more often by holding a conference on the subject, once in two years (in a non-AIRAPT year). The first such national conference was recently held at National Aerospace Laboratories (NAL), Bangalore, in which 50 papers authored by over 100 scientists, were presented.

Prof. S. Ramaseshan, who was the first to introduce high pressure research at the NAL's Materials Science Division in 1971, delivered the inaugural lecture. He began his lecture by saying that he was



Dr A.K. Singh welcoming Prof. S. Ramaseshan and other delegates at the first National Conference on High Pressure Science and Technology

greatly honoured to be invited and insisted that "as an old man" it was his privilege to reminisce. The reminiscences were very delightful: G. S. Ranganath's work on pressure induced optical activity, Ramaseshan's overall gameplan for high pressure research at NAL which triggered off projects in spark erosion, electrochemical machining, high pressure sintering and all the work on chromium ("chromium can flow like grease at high pressure") which ended with the experience of Krupp seeking to place orders for enormously large quantities of the stuff. "CSIR was flabbergasted and didn't even know how to react to such a request those days!" The reminiscences were accompanied by homilies which were equally delightful: "K. S. Krishnan's discovery is today called the Ziman theory. You understand how these things happen of course!", or, "we were the first in the world to start work on electrocomposites; Rolls Royce picked it up later", or, "we all have our vices. Anomalous scattering happens to be my vice!"

Dr B.R.Somashekar welcomed the gathering. Dr A.K. Singh introduced the conference programme

and Dr T.G. Ramesh proposed a vote of thanks. But Prof. Ramaseshan's wonderful opener, and the customary professional élan with which the Materials Sci-

ence Division organizes such meetings, ensured that the meeting was a fulfilling professional experience for its participants. □

Workshop on Pavement Performance Study and Emerging Deterioration Models

The Central Road Research Institute (CRRI), New Delhi, has completed the first phase of a major road research project 'Pavement Performance Study (Existing Pavement Sections)' under the sponsorship of Ministry of Surface Transport. Pavement deterioration models have been developed for local conditions, first time in the country, for prediction of pavement distress. These models will provide important inputs to the highway professionals for developing appropriate Pavement Management Systems (PMS) in the country for: (i) prediction of expected deterioration of the road network, (ii) assisting the policy makers in allocation of funds for maintenance of roads, and (iii) evolving optimal maintenance and rehabilitation (M&R) strategies.

CRRI organized in the recent past a one-day workshop on 'Pavement Performance Study and Emerging Deterioration Models' to disseminate the results of this research project to practising engineers, for their use in evolving and evaluating strategies for maintenance and rehabilitation (M&R) of roads. The workshop was inaugurated by Shri C.N. Ramdas, Secretary, Ministry of Surface Transport. Shri Ramdas in his address expressed concern over the deteriorating road conditions in the country and hoped that pragmatic recommendations on financing the maintenance of the vast road network in the country will emerge from the workshop deliberations. Prof. D.V. Singh, Director, CRRI, in his welcome address mentioned that the pavement deterioration models developed by the institute



Shri C.N. Ramdas, Secretary, Ministry of Surface Transport delivering inaugural address at the Workshop on Pavement Performance Study and Emerging Deterioration Models. Seated on the dais (from left) are: Prof. D.V. Singh, Prof. S.K. Khanna, Dr S.K. Joshi, Shri D.P. Gupta and Shri V.K. Sood

are a landmark on the Indian highway scene, being the first of their kind in the country. Dr S.K. Joshi, Director General, CSIR, presided over the inaugural function. In his presidential address Dr Joshi pointed out that in view of the new economic policies and reform programmes in the country, the CSIR laboratories have reoriented their R&D efforts to suit user agencies. He extended invitation to highway professionals to collaborate with CRRI in maintaining the costly road assets in an efficient manner. Prof. S.K. Khanna, Chairman, CRRI Research Council and Shri D.P. Gupta, Director General (Road Development), Ministry of Surface Transport, also addressed the participants.

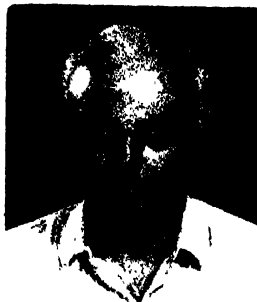
Over 100 experts including practising engineers from different road organizations, researchers, academicians and consultants from across the country participated in the workshop. A base paper on Pavement Performance Study and Emerging Deterioration Models was presented by Shri V.K. Sood, Head, Pavement Performance Study Division of CRRI. The participants complimented the institute for providing important tools to the highway professionals in the country, for planning of M&R measures for upkeep of the road network. A number of suggestions were made by the participants for further refinement of the models. Some of which are being implemented in the second phase of 'Study of New Pavement Sections', which has also been launched.

Besides the presentation of the research findings, a panel discussion on 'Modalities for Application of Models to Pavement Management System Projects in India' was also organized. A computer package, 'PDM', on use of the deterioration models developed by the institute, was demonstrated to the participants. □

Honours & Awards

Dr K.S. Yajnik

A biographical sketch of Dr K.S. Yajnik, Head, Centre for Mathematical Modelling & Computer



member of the All India Board of Post-graduate Education and Research in Engineering and Technology by All India Council for Technical Education (AICTE), a statutory body of the Government of India.

This Board would act as an advisory body of the Executive Committee of AICTE on academic matters falling in its area of concern, including norms, standards, model curricula, model facilities, structure of courses and matters relating to growth of national education in higher education system.

Simulation, Bangalore, appears in *Who's Who in Engineering* (9th edition) published by the American Association of Engineering Societies (1994).

Prof B.B. Dhar

Prof. Bharat B. Dhar, Director, Central Mining Research Institute, Dhanbad, has been nominated a

Shri K.R. Prakash

Shri K.R. Prakash, Scientist, Engineering Services Division National Aerospace Laboratories, Bangalore, has been conferred the Fellowship of the Indian Institution of Industrial Engineering by its National Council. □



Shri K.R. Prakash being conferred Fellowship of the Indian Institution of Industrial Engineering at the Institute's XXXVI National Convention

Printed and Published by Dr G.P. Phondke, Director, Publications & Information Directorate (PID), Dr K.S. Krishnan Marg, New Delhi - 110 012
Printed at PID Printing Unit

Editors : Dr B.C. Kashyap and Madhu Sahni

Phone. 5786301

Gram: PUBLIFORM

Production : Kaushal Kishore

Telex: 031-77271

Annual Subscription : Rs. 60

E-mail: pid@simetd.ernet.in.

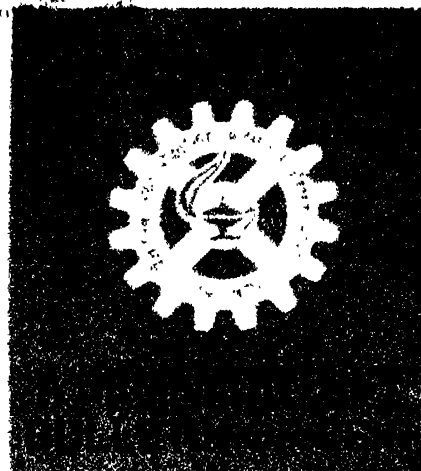
Single Copy: Rs. 3.00

Fax: 5787062

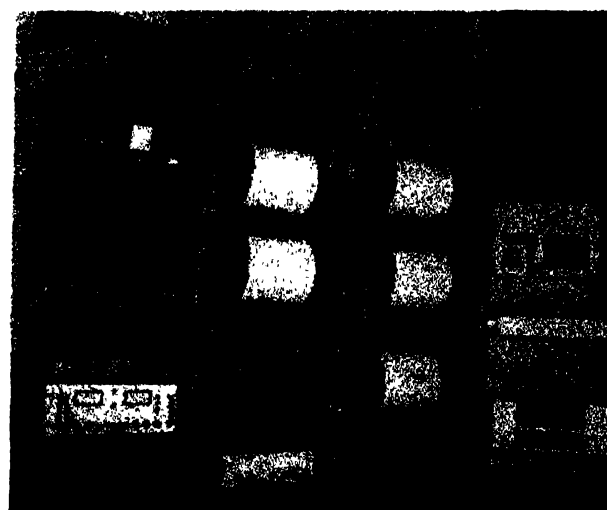
RN 4512/57

CSIR

NEWS



VOL 45 NO 2 30 JANUARY 1995



Clockwise from left: 16-DPA pilot-plant and VSK mini cement plant based on the technology developed at the Regional Research Laboratory, Jorhat and Central recording station of the seismic surveillance telemetry network at the laboratory.

A report on RRL-Jorhat's role in exploiting the natural resources of the North-Eastern region of the country appears on p. 18.



Exploiting the Riches of the North East—RRL-Jorhat shows the way

The North-Eastern region of India is bestowed with an abundance of natural resources like petroleum, natural gas, minerals, tea as well as aromatic and medicinal plants. The Regional Research Laboratory (RRL) Jorhat, a multi-disciplinary laboratory of CSIR, has over the years developed a large number of technologies for the judicious exploitation of these resources; forty-six of the technologies developed have been transferred to over 400 parties. The strength and accomplishments of the laboratory in the various disciplines are highlighted here:

Organic Chemicals & Intermediates

RRL-Jorhat has a strong organic chemistry group comprising highly qualified and experienced S&T personnel who have developed technologies for the production of several chemicals and intermediates.

The R&D areas include: Chemical investigation of traditional medicinal plants, and development of processes for herbal drugs, plant-based antimalarials, antifeedants, anti-AIDS, anti-cancer and anti hypertension agents, steroidal drugs and drug intermediates, essential oils and perfumery chemicals, nucleosides, mosquito repellents, plant growth regulators, β -lactam antibiotics and pesticides.

Technologies have been developed/are being developed for:

Plant-based chemicals: Diosgenin, 16-DPA, Caffeine, Solasodine, Berberine, Artemisinin and analogues and Taxol and analogues.

Pesticides: Phosphamidon, Quinalphos, Chlorfenvinphos, Glyphosate, Edifenphos, Captan, Vapam, Acephate, Fenthoin and Methamidophos.

Drugs and Drug Intermediates: Norgestrel, Phenyl butazone, 8-

Hydroxyquinoline and Aminobenzophenones.

Others: Cycocel and tributyl, triethyl, trimethyl and triphenyl phosphates.

Recently, under the ICICI-USAID programme, a Rs 15 million research project has been sponsored to the laboratory by a Bombay based private firm for the development of a commercial scale process for 16-dehydropregnenolone acetate (16-DPA). 16 DPA is the key intermediate for many important and high priced life saving corticosteroid drugs like betamethasone. The starting materials for 16-DPA and diosgenin and solasodine, which are obtained from the indigenous *Dioscorea* and *Solanum khasianum* plants. The name *khasianum* relates to Khasi hills of Meghalaya. Patent applications for the new RRL-Jorhat processes have been prepared for filing in various countries including USA.

Material Sciences

VSK Mini Cement Plants: The development of Vertical Shaft Kiln (VSK) cement plant technology is a major achievement of the laboratory, based on which 36 mini cement plants have been established in the various parts of the country. Recently, a private sector company in Karbi Anglong, Assam, has entered into an agreement for a turnkey consultancy project with RRL-Jorhat for a 30,000 tonnes per annum capacity cement plant. This will be the biggest VSK cement plant in North-East India. Several companies from various developing countries have shown keen interest in the VSK technology developed at RRL-Jorhat.

The laboratory has also developed technologies for a number of



High strength proppants

chemical additives for mineral beneficiation, and silica sol. Several processes have been successfully exploited for commercial production. The areas of R&D include: beneficiation, characterization and utilization of ores/minerals/coal, cold-bonded pelletization of iron ore fines, Development of dielectric ceramic materials, and Assessment of gold content in the Subansiri river sands in Assam.

Petroleum and Oil Field Chemicals

RRL-Jorhat is a leading name in R&D in the area of oil-field chemicals. During the past two decades, the laboratory has developed tremendous expertise and capabilities in this field. Facilities are being built up to develop state-of-the-art technologies and expertise to meet the challenges of the oil industry. A geomicrobiological and eco-friendly method for hydrocarbon exploration has been developed which is being actively tried in oil-fields in Assam and Ganga Valley. A process for

making high strength proppants from locally available raw materials for enhanced crude oil recovery has also been developed.

Areas of expertise include: Geomicrobiology, Petroleum additives, Testing and analysis of petroleum products, Crude oil transportation chemicals, Petroleum microbiology, Deoilers and de-emulsifiers, Rheology of crude oils, Drilling mud chemicals, and Polymer chemistry.

Technologies have been developed for Micro-crystalline wax, Flow improvers; SWAT-104, 106, FIRJ-B, BHC and KMC for waxy crude oils, High strength proppants, Drilling mud additives, Formation stabilizers, Dibenzyl disulphide, and Recovery of wax from spent fuller's earth.

Paper and Boards

Expertise exists for Speciality papers, Papers and fibre boards, and Roofing sheets.

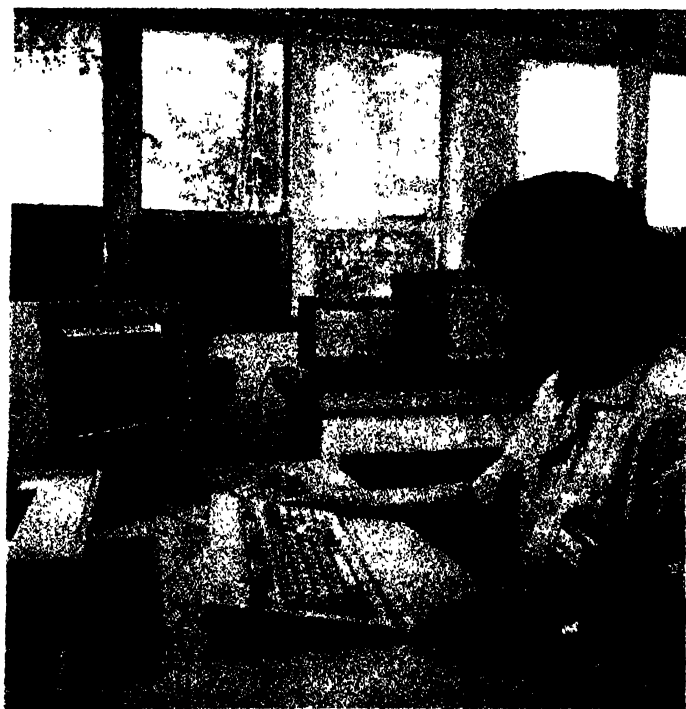
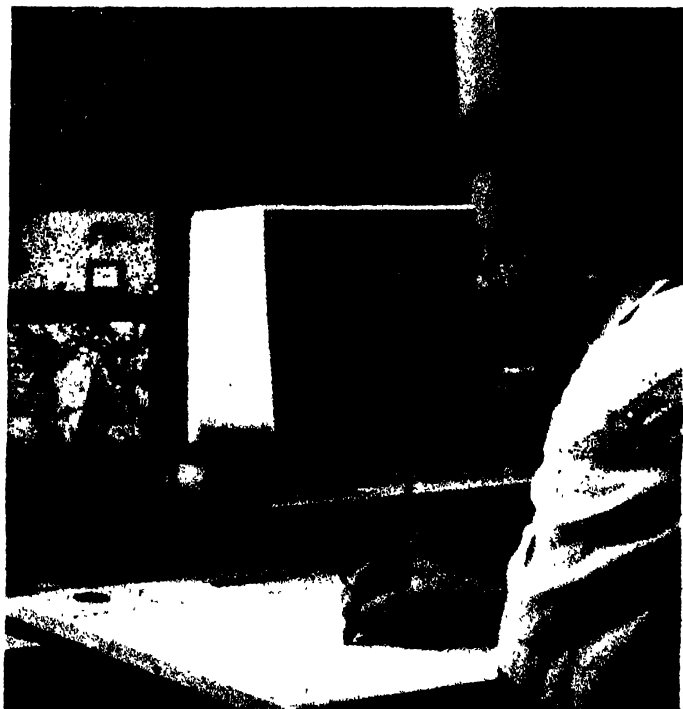
Technologies have been developed for Carbonless copy paper, Heat sensitive paper, Direct copy paper, Matrix board, Fibre board, and Dry strength additives. Twenty-seven processes and formulations have been developed of which 18 processes have been successfully transferred to industry for commercial production.

Biosciences

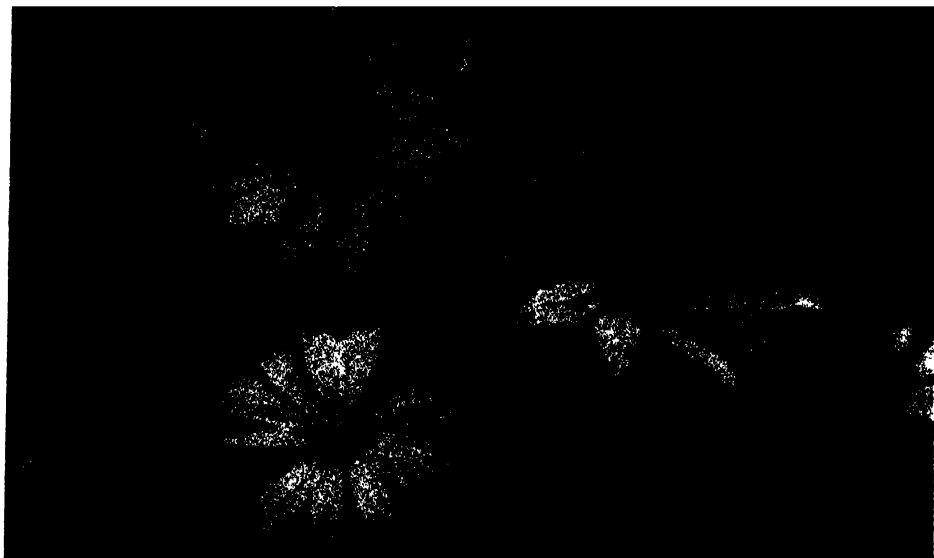
The R&D programmes in biosciences relate to Plant molecular biology, Plant growth promoters, Microbial conversion of steroids, Fermentation technology, β -lactum antibiotics, Soil microbiology, Bacterial biocides, Microbial anti-termite products, studies on *Muga* silk worm, Microbial enhanced oil recovery, and Microbial desulphurization of coal and petroleum.

Agrotechnologies

The laboratory is engaged in the development of agrotechnologies for successful propagation of high-value aromatic plant species such as citronella grass, lemon grass



Some of the technical services facilities at RRL-Jorhat



Anti-feedants producing flowering plant



Cultivation of citronella grass

and patchouli, and extraction of oil thereof. These activities have generated employment avenues for more than 20,000 families in rural and hilly areas of North East India. Today, more than 450 MT of citronella oil and related products are being produced using the RRL-Jorhat technologies. Also, various life-saving drugs and herbal medicines are being extracted from forest resources, thereby generating agro-based industries in the organized sector. Likewise, protein-rich edible mushroom species grown wild in the hills and terrains

of the north-eastern region of India are being identified and supplied to entrepreneurs and villagers for commercial exploitation. Studies on selected fast growing plants have been undertaken for generating raw materials for paper industries and to support wasteland management.

Technologies have been developed for extraction/production of Citronella, Lemon grass, Patchouli, Ocimum and Palmarosa oils, and Citronellal, Hydroxy citronellal, Citral, Esters of citronellol and gera-

niol, Piperitone, Eugenol, and Methyl eugenol. Also agrotechnologies have been developed for *Dioscorea floribunda*, *Dioscorea composita*, *Solanum khasianum* and Edible mushrooms.

Geosciences

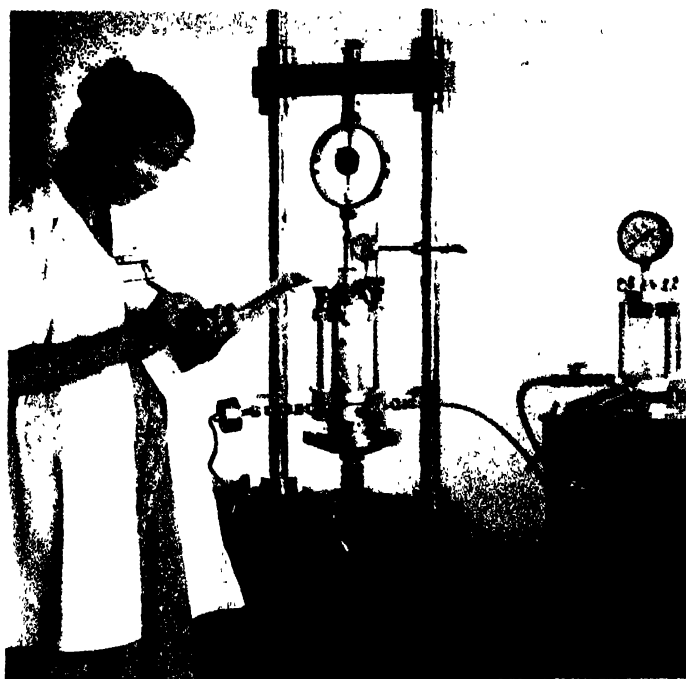
The north-eastern region of India is the most seismically active zone and was the seat of several large and destructive earthquakes including those of 1897 and 1950. The premonitory seismic study which revealed that the region is likely to be affected by large earthquake by the turn of this century warranted intensive earthquake monitoring. This laboratory has established conventional and telemetered network in this region to monitor local seismic activities.

Earthquake data accrued from these seismic networks are published in the form of annual seismological bulletins. Teleseismic records appear regularly in the *International Seismological Bulletin* published by International Seismological Centre, Newbury, Edmburg, U.K. In addition to the telemetered and conventional network of seismic stations, facilities exist for on-line semi real-time computer data processing, and characterization of metals and minerals.

Engineering Sciences

RRL-Jorhat undertakes geotechnical investigation for design of suitable foundation of structures and has the expertise in soil engineering and building materials. Prestigious assignments include detailed soil investigation for the Numaligarh refinery at a cost of Rs 3.2 million, geotechnical investigation of Digboi refinery modernization project, gas-based power project at Kathalguri for NEEPCO, LPG recovery plant at Lakwa for Gas Authority of India Ltd, and oil storage tanks for ONGC amongst others.

Area of expertise relate to Geotechnical investigation, Soil



Soil testing



Loop reactor experiments

testing, Low-cost building materials, Hazard and risk analysis, Foundation design and evaluation of building materials, Water filter candles and Membrane technology applications, and Industrial effluent treatment.

Ecology and Environmental studies

The tropical rain forest of sub-Himalayan south-eastern region provides a plethora of valuable medicinal and economic plants which have been used for many centuries in life-saving herbal preparations. Even today, almost all ethnic groups in the hills and plains of this area routinely use these reme-

dial agents for treatment of various ailments. The region contains many rare plants which can be the commercial source of valuable anti-malarial, anti-cancer, anti-hypertension and anti-AIDS agents as well as high-value perfumery chemicals and alkaloids.

During recent years, a major crisis in this part of the world has been the indiscriminate deforestation resulting in ecological imbalance. In order to maintain and preserve these economical and endangered species, RRL-Jorhat has set up an ecological park — the North East Ecology Park (NEEP) within its campus. NEEP would serve as a gene bank for undertak-

ing studies on improvement and multiplication of these species through genetic engineering and tissue culture. Orchids of the region which have ornamental value as well as great economic importance also find a place in NEEP.

In order to evolve corrective measures towards prevention of environmental degradation caused by the various industrial activities and indiscriminate deforestation, the laboratory has undertaken various programmes for protecting as well as preserving the environment, and rendered expert services to user industries in combating their environmental and pollution problems. □

Manufacture of Lubricating Oil Base Stocks — A technology overview

Dr HIMMAT SINGH

**Group Leader, Lube Base Stocks Processing, Bitumen and Carbon Materials,
Indian Institute of Petroleum, Dehra Dun**

Modern lubricants are formulated from a range of lubricating oil base stocks and chemical additives. They provide a fluid layer

between moving surfaces and remove heat and wear particles, while keeping the friction to a minimum.

Majority of the base stocks are manufactured by refining of crude oil. The world-wide base-oil outlook for the year 1994 as per the esti-

mates of NPRA was: Manufacturing capacity - 835 MBPD, supply - 710 MBPD (85% of capacity) against an estimated demand of 653 MBPD. Over 42% of the total base stocks manufacturing capacity was estimated to be located in Europe, while Asia accounted for 19.4% only. Reasons for the predominance of refined petroleum base stocks are obvious - performance, availability and price. Non-petroleum base stocks are generally used only to meet some specific requirements.

The first step in the processing of base stocks is the separation of the fractions according to viscosity and boiling range specifications in the crude oil distillation units. The heavier lube oil raw stocks are included in the vacuum fractionating tower bottoms with the asphaltene, resins and other undesirable materials.

The raw lube stocks from most crude oils contain components which have undesirable characteristics for producing finished lubricating oils. These must either be removed or reconstituted by processes such as liquid liquid extraction, crystallization, selective hydrocracking and/or hydrogenation. The undesirable characteristics include high pour and cloud points, large viscosity changes with temperature (low VI), poor oxidation stability, poor colour, high organic acidity, and high carbon and sludge forming tendencies. The processes used to change these characteristics are:

(a) *Solvent (Propane) deasphalting* — Reduction in carbon and sludge forming tendencies.

(b) *Solvent extraction/hydrocracking* — Improvement in viscosity index.

(c) *Solvent dewaxing/selective hydrocracking/hydroisomerization* — Lowering of cloud and pour points.

(d) *Hydrofinishing/clay finishing* — Improvement in colour and oxidation stability, and also lowering of organic acidity.

For economic as well as technical reasons, the sequence is usually in the order of vacuum distillation, deasphalting, solvent extraction, dewaxing and finishing. However, the sequence of dewaxing and finishing processes is sometimes reversed to meet specific requirements. In general, the cost and complexity of the process increase in the same order.

Several processing configurations have been commercially practised. The conventional configuration which employs the solvent processing technologies is quite prevalent in Indian lube refineries, combinations of which for HVI base oils production are given in Table 1.

In this configuration, lube oil base stocks are obtained by treating raw lube fractions in a sequence of physical separation processes, where the required hydrocarbon structures are progressively separated. As of today, this configuration offers the advantage of being proven and familiar, but it suffers a major disadvantage in its dependence for quantity and quality of products in the initial feed and type of crude.

New Technology Trends

Demands for improving automotive fuel and oil consumption have increased the need for lower viscosity, very high VI (VHVI, 120-

130) and extra high VI (XHVII40), multigrade oils with reduced volatility. This has made increasingly difficult for conventional solvent-refined-base oils to meet the performance needs of modern engines, despite improvements in additive technology. Therefore, it is anticipated that there will be an increased use of hydrotreating/hydrocracking and/or wax isomerization technologies. To overcome immediate problems of improving the base oil yields and product quality, petroleum refiners are considering modification of existing plants based on combination of mild hydrotreating and solvent extraction or vice versa approach with a view to process the increasingly available poor quality crudes (with respect to lubes) and still maintain the required base oil quality.

In general, the hydrogen treating processes upgrade the molecular structures of low VI hydrocarbons into more acceptable types and/or modify the wax structures to improve flow properties alongwith reduction in sulphur, nitrogen and aromatic compounds to very low levels. All these changes yield base oils having different chemistry and improved performance as compared to stocks obtained by traditional refining. This approach makes it possible to extend the range of crudes for lube oil production.

Current Status of Work at IIP

The Indian Institute of Petroleum (IIP), Dehra Dun, has made, over the years, significant contributions

Table 1: Refining processes in Indian Lube Refineries for HVI grades

Refinery	Extraction Present	Expn.	Dewaxing	Finishing
HPCL Bombay	Phenol/NMP	NMP	Propane	Hydro
MRL Madras	Furfural	NMP	MEK/TOL	Hydro
IOC Haldia	Furfural	NMP**	MEK/TOL	Hydro
IOC Barauni*	Phenol	NMP**	MEK/TOL	Clay
* Non-lube refinery ** Expected change-over				

to the area of lube base stocks processing and characterization [CSIR News, 44 (1994), 101]. The institute's current projects in this area include those related to: (i) studies on combination process scheme involving mild hydrotreating and solvent extraction for lube base stocks, (ii) studies for improvement in base oil quality in the existing lube refineries, (iii) establishment of production feasibility in respect of certain high VI base oils with acceptable oxidation and other specified characteristics, and (iv) studies on lube base stocks characterization and additive response.

The NMP developed by IIP base lube extraction process, in collabora-

tion with EIL and an operating refinery and accepted for change-over of phenol extraction unit at Barauni Refinery, is expected to be a commercial reality in the near future.

Work on the development of additional sources of high BMCI carbon black feed stocks and improvement in the quality of existing feed stocks, particularly the lube extracts, using solvent extraction approach is another active area of research being pursued currently.

A new project involving eco-friendly technology for re-refining of used oil is under active consideration. □

structural facilities to serve as Regional National Oceanographic Data Centre for the Indian Ocean, and emphasized that in addition to rescue old data, the new data being collected at a high cost to the exchequer, should be regularly deposited in the Data Centre.

Welcoming the delegates, Dr E. Desa, Director, NIO, spoke on the significant role that NIO can play in the Indian Ocean data and information management as a part of the international programme.

Speaking on behalf of IOC, Dr I. Oliouine, Head of the Ocean Services Division, mentioned that GODAR is one of the very successful projects being pursued with the hope that the whole oceanographic community will be benefited substantially.

Dr S. Levitus, Leader of the GODAR Project, acknowledged the cooperation of the international oceanographic community in helping him to come up with the present data holding products, and presented a set of nine CDs containing the global data sets on oceanographic parameters and a

International Workshop on Global Oceanographic Data Archaeology and Rescue

The Indian National Oceanographic Data Centre of the National Institute of Oceanography (NIO), Goa, organized an international workshop on 'Global Oceanographic Data Archaeology and Rescue' (GODAR) as a part of the project being operated by Intergovernmental Oceanographic Commission of UNESCO, under the leadership of Dr S. Levitus, Director, WDC-A, Washington. The workshop, sponsored by IOC, NOAA, DOD and CSIR and held at NIO during 6-9 December 1994, was third in the series; the earlier ones were held in Russia and China.

The objective of the workshop was to help locate and rescue oceanographic data in danger of being lost, assisting IOC Member States of the Indian Ocean region in oceanographic data archaeology and rescue operations and formulation of an implementation plan for rescue operations. Thirty-three scientists, including about a dozen from abroad, participated in this workshop.

Dr S.K. Joshi, Director General, CSIR, inaugurated the workshop. In his address he stressed the need for free exchange of data and information among the oceanographic community for the benefit of all. He said that NIO has both expertise as well as infras-



Dr S.K. Joshi, Director General, CSIR, delivering the inaugural address at GODAR Workshop. Seated on dais (from left) are: Dr R. Bhargava, Dr S. Levitus, Dr I. Oliouine and Dr E. Desa

set of data reports and atlases to Dr Desa.

Dr R. Bhargava, Head of INODC, proposed a vote of thanks at the inaugural function.

The workshop was held in three parts:

1. *Presentation of scientific papers*: Thirteen papers were presented and discussed. These included five from India and eight from other countries.

2. *Presentation of national reports*: Four reports were presented on oceanographic data management and related activities being undertaken in six countries including India. The Indian work at INODC was very much appreciated and lauded by all participants.

3. *Round table discussions*: The third part included a free and constructive discussion on national reports, rescue & archaeology of data, preparation of data products and implementation plan. The delegates formulated a set of recommendations which would be sent to IOC secretariat and its member states, for implementation.

Dr Mark Thorley presented a book entitled *Southern Ocean Ecology — The Biomass Perspective*, on behalf of the British Antarctic Survey to Dr R. Bhargava. □

Seminar on Electroplating

Over 200 delegates from different parts of Tamil Nadu attended a Seminar on Electroplating at the Central Leather Research Institute (CLRI), Madras, during 9-10 December 1994. The seminar was organized by the Central Electrochemical Research Institute (CECRI), Karaikudi, in collaboration with the Swadeshi Science Movement, Karaikudi. It was inaugurated by the CLRI Director, Dr

K.V. Raghavan; Prof. G.V. Subba Rao, Director, CECRI, presided over the inaugural function. Shri S. John, convener of the seminar, spoke about the scope of the seminar. He said that the electroplating industry offers a great employment potential, and added that in the light of global competition it has become necessary to modernize this industry. Prof. K.I. Vasu, National Coordinator, Swadeshi Science Movement; Dr K. Bala Krishnan, Deputy Director, CECRI; Shri V.S. Kulkarni, Director, Grauer & Weil (I) Ltd, Bombay; Shri H. Ayyasamy, Technical Director, Artek Surfin Chemicals (P) Ltd, Bombay and Shri M.P. Murugesan, President, Tamilnadu Electroplaters Association, offered felicitations. Shri V. Rengarajan, Secretary, Swadeshi Science Movement, proposed a vote of thanks.

The inaugural function was followed by six technical sessions in which 17 lectures on different aspects of electroplating were delivered by eminent scientists and industrialists. A question-answer session was also arranged to clear the doubts of the participants from the industry. A special feature of the seminar was an exhibition of latest products of the leading electroplating industrial units. □

NAL-UNI Lecture Series

CFD — Advances and Applications

The eighth course in the NAL-UNI Lecture Series-Pt. II, on Computational Fluid Dynamics (CFD). Advances and Applications, held recently at the National Aerospace Laboratories (NAL), Bangalore, drew an excellent response. There were 24 participants including 12 from outstation. Dr K.N. Raju, Director, NAL, welcomed the gathering and said that it was the

right time to hold such a course since CFD had reached a level of maturity in the country after making rapid strides in the last five years. "CFD helps us develop new understanding on the physics of flow and, since nature has the uncanny gift of never revealing all its secrets at the same time, CFD will continue to throw up exciting and enduring surprises in the future", he added. Dr S.S. Desai, Head, CTFD Division, then introduced the course. Dr Desai's introduction was notable for its quick review of the history of CFD work in the past two decades. "Classical fluid dynamics has given way to computational fluid dynamics quite recently; essentially after the advent of high performance computers", he said. He added that the true potential of CFD is only now beginning to be recognized. Recalling his recent study with Prof S.M. Deshpande on the status of CFD in India, Dr Desai noted that CFD is still not "sufficiently well-spread" in the country and still continues to be largely driven by aerospace applications. "But I see a more multi-faceted CFD personality emerging very soon. We have already begun applying CFD to diverse industrial problems - in welding, for example, or in determining clean room specifications, and exciting times lie ahead", Dr Desai noted.

The faculty for the course comprised nine scientists of the NAL's CTFD Division. The course notes containing over 400 pages of technical material were given to the participants. When asked if it was humanly possible to assimilate these 400 pages in two and a half days, the course coordinators, Dr Sekhar Majumdar and Dr M.D. Deshpande, explained that the idea was to deliberately develop lecture themes in great detail so that participants "can carry back something really solid and useful" at the end of the course. □

ITRC celebrates Foundation Day

The Industrial Toxicology Research Centre (ITRC), Lucknow, celebrated its twenty-ninth Foundation Day on 4 November 1994. Prof. Newman L. Stephens of the Physiology Department, University of Manitoba, Canada, who was the Chief Guest on this occasion, delivered the Foundation Day address. Prof. S.S. Parmar of the Department of Physiology, Ross University, School of Medicine, Roseau Commonwealth of Dominica, East Indies, presided over the function.

In his address, Prof. Stephens, an alumni of the King George's Medical College, Lucknow, referred to various occupational diseases caused by toxic chemicals in the work environment. He particularly mentioned occupational asthma which is a widespread and serious disease caused by exposure to sensitizing agents like grain dust; metals like cobalt, nickel, platinum salts and chromates; drugs like penicillin and tetracyclines; isocyanates; plants; cigarette smoking; etc. The disease is also caused by some food additives like tetrazine which is a yellow-dye used for colouring foods. He said recovery is possible, if diagnosis is made early, and the patient is removed from exposure. Prof. Stephens also referred to the methods of early diagnosis of the disease and its treatment.

While concluding his address, Prof. Stephens appreciated the work being done by ITRC which has now become a world renowned laboratory in the area of industrial and environmental toxicology, and congratulated its scientists for their achievements and accomplishments in basic and applied toxicology.

Prof. Parmar, who was earlier Professor of Medical Chemistry and Chemical Pharmacology at the

King George's Medical College, Lucknow, while delivering the presidential address referred to the variety of toxic substances present in air, water, food, etc. confronted by humans in daily life. He said that some of these could adversely effect the biological systems such as the central nervous system, reproductive system and cardiovascular system. He stressed the need to develop the discipline of preventive toxicology so that proper measures could be taken to counteract the toxic effects of chemicals in the workers getting exposed to such chemicals and provide proper management of the affected human population. He called for strict regulatory control to check and screen the toxic chemicals being released into the environment. Referring to R&D at ITRC, Prof. Parmar said, "I have known this institute since its inception which has developed into an excellent laboratory in the field of toxicology whose contributions are recognized world-wide, and the expertise of its scientists is sought by several international agencies. He congratulated the scientists for their excellent contributions to the toxicological research, particularly related to metals, pesticides and

hydrocarbons and said that ITRC has a major role to play in India's sustained development, free from undesirable effects of toxic substances.

Earlier, Dr R.C. Srimal, Director, ITRC, welcomed the guests and presented the Annual Report of the laboratory. He said that ITRC remained in the forefront in tackling environmental and human health problems, and interacted with national regulatory agencies and authorities for ensuring safety of industrial workers and the common man by participating in National Mission Programme, and mission-oriented institutional R&D programmes. He said that under the Rajiv Gandhi National Drinking Water Mission of the Government of India, ITRC, organized a number of training courses to train grass-root level workers in villages for water quality monitoring and testing, and demonstration cum public awareness camps to make the masses aware of the health problems associated with contaminated water and ways to protect themselves. Keeping in view the problem of fluorosis, ITRC organized fluorosis awareness camps to inform people about the health hazards associated with fluoride contamination of water. He



Seen on the dais during the ITRC foundation day function (from left) are: Dr K.P. Pandya, Prof. S.S. Parmar, Prof. N.L. Stephens and Dr R.C. Srimal

emphasized the need for monitoring of fluoride levels in various districts and continuous monitoring of the health of population living in areas with higher fluoride levels, so that necessary preventive measures can be taken. He further said that ITRC has initiated studies for removal of fluoride and nitrates from drinking water and is developing an online device for disinfecting water for drinking purposes. He said that ITRC, under the sponsorship of the Ministry of Environment & Forests, is participating in the monitoring of the Gomti river for pollutants like pesticides and metals at eight different locations in Uttar Pradesh.

Referring to ITRC's interactions with industry, he said that ITRC continued to provide its R&D services to industries through toxicity testing, environmental monitoring and environmental impact assessment, safety evaluation, etc. The laboratory has recently signed a memorandum of understanding with Steel Authority of India, New Delhi, to provide chemical safety information and undertake R&D projects to solve its pollution and toxicological problems.

He said that in order to deal with major R&D programmes of the country, the institutional R&D work has been prioritized and grouped into six areas, viz. (1) Biomodulation of Toxicity; (2) Human Exposure and Health Risk Assessment; (3) Neurotoxicology; (4) Environmental Toxicology; (5) Chemical Toxicology; and Respiratory Toxicology, and curiosity-oriented projects have been given low priority. Emphasis is being laid on the programmes which would benefit the rural and underdeveloped regions, such as utilization of fly ash, a bypro-

duct of coal-based thermal power plants, in agricultural farming, and the evaluation studies of the gasoline-methanol mixture in view of its intended use as alternative fuel. He also referred to ITRC's continued food material surveys for safeguarding the human health from toxic food adulterants.

Dr K.P. Pandya, Deputy Director and Head, Petroleum Toxicology Division, proposed a vote of thanks. □

Flosolver on View

The National Aerospace Laboratories, Bangalore's Parallel super-computer was exhibited at the First International Workshop on 'Parallel Processing', which was held at The Oberoi in the last week of December 1994. The exhibition was perhaps the first instance when all the major actors in India's parallel processing community (DRDO — Anurag; NAL — Flosolver; BARC — Anupam and C-DAC-Param) were under one roof.

The T-80 weather prediction code, which has been successfully parallelized on the Flosolver Mk 3 version, was run continuously on all three days of the exhibition. By doing so, NAL sought to establish the point that the real test for a parallel computer was to run a complex computer code efficiently for a significant period of time without any interruptions or breakdowns. □

Workshop on Intake Aerodynamics

The one-day Workshop on Intake Aerodynamics, held at the Belur

Campus of National Aerospace Laboratories (NAL), Bangalore, on 11 November 1994, was an event of considerable significance because it provided an opportunity for scientists from its five sponsoring organizations, viz. ADA, HAL, DRDL, VSSC and NAL, to discuss their experiences in the design and development of air intakes. The workshop, which featured 16 presentations spread across five sessions, discussed aircraft, missile and ramjet intakes.

Dr M. Shivakumara Swamy welcomed the participants and Dr K.N. Raju formally inaugurated the workshop. In his opening remarks, Dr Raju expressed his happiness that NAL was hosting the workshop and recalled with pride the events which led to the successful design and development of the 1/4 scale LCA high speed air intake model in 1990. "That first effort was important because it has triggered off so much activity in the design and development of composite aircraft models at NAL", Dr Raju observed.

Prof. M. A. Ramaswamy of IISc delivered an illuminating lecture on 'Intake Aerodynamics — Its Significance'. In this lecture Prof. Ramaswamy presented a scholarly overview of air intakes, making many observations on the Indian studies on the subject with which he has been deeply involved. He also made several suggestions on what should be the future areas of study.

The inaugural function ended with a vote of thanks by Dr Sajeer Ahmed, who together with his colleagues worked hard to organize the workshop. □

Annual Chrysanthemum and Coleus show at NBRI

Organization of flower shows is a regular feature at the National Botanical Research Institute (NBRI), Lucknow. Aimed at developing aesthetic sense and creating a general awareness about ornamental horticulture and floriculture among the masses, these flower shows attract a large number of participants and visitors.

The 'Chrysanthemum and Coleus Show' organized at NBRI every year marks the advent of winter season flowers in India, and is viewed by experts as the biggest show of its kind in the country. This winter, this show was held on 3-4 December 1994. It was categorized in seven main classes and 123 sections for the competitors which included government, semi-government and autonomous bodies and nurserymen. Besides some sections were restricted to individual groups of ladies and some to *malies*. The show attracted 1476 entries (132 more than the previous year) from 156 competitors. On display were numerous cultivars of chrysanthemum — potted as well as cut flowers, large and small flowers both in bright and muted shades with perfectly sym-

metrical heads along with the arrays of coleuses in their multiple hues and shades.

In floral arrangement some of the attractive thematic arrangements displayed were: 'Tender is the encouragement to life', 'Unity in diversity', 'All that glitters is not gold', 'Ekla chalo re' and 'The best thing to give your enemy is forgiveness'.

A panel of 25 distinguished judges drawn from different parts of the country decided the prize-winning entries. Shakti Bhawan, Lucknow, turned out to be the most successful exhibitor by bagging four running trophies/shields. The 'King of the Show' was awarded to Shri Mahmood Ahmad, while 'Queen of the Show' was lifted by Headquarters, Central Command, Lucknow. Lt. Gen. A.K. Gautam, G.O.C.-in-Chief, Central Command, Lucknow, lifted the 'Flower of the Year' (*Sonar Bangla*).

Also displayed were some of the new cultivars/varieties developed at NBRI. These included: *Shabnam*, *Man Bhawan*, *Alankar*, *Agnisikha*, *Sheela*, *Navneet*, and a new mutant *Balik*.

Potted plants trained in different styles, namely Sen Rin Tsukuri, Cascade, mini-culture, landscape culture, polybag culture and traditional bush and standard forms and cultural methods for producing giant and pigny plants bearing blooms in proportionate size were exhibited. New additions to this list were mini-plants in bloom, grown in coffee/tea/ice cream cups. The unparalleled diversity in chrysanthemum with respect to plant height, bloom size, colour and floral shape was very much evident at the show. Some newly acquired uncommon cultivars of exhibition type large flowered chrysanthemum were also displayed.

The prize distribution function was attended by a large gathering. Shri Motilal Vora, Governor, Uttar Pradesh, presided over the function and gave away 15 running challenge shields/trophies and cups to the successful competitors. Besides these 420 other prizes were awarded by the Chief Justice of Allahabad High Court, Shri S.S. Sodhi and Smt. Sodhi. Speaking on the occasion Shri Vora pointed out that the flowers which are intricately related to our culture, not only have ornamental and religious values but also a lot of commercial



Shri Motilal Vora, Governor of Uttar Pradesh going round the NBRI Chrysanthemum and coleus show

value. Therefore, floriculture should be encouraged. This would also generate job opportunities. He applauded the R&D endeavours of NBRI in this direction.

Dr P.V. Sane, Director, NBRI, welcomed the chief guest and highlighted the genesis and importance of the flower show. He also informed about the R&D achievements of the institute in the area of floriculture.

Dr M.R.Ahmad, Scientist & Head, Information Section, compared the function and Dr S.C. Sharma, Head, Botanic Garden, proposed a vote of thanks. □

Seminar on Application of Nucleonic Control Systems to Coal Processing Operations

Dr Kotur S.Narasimhan, Director, Central Fuel Research Institute, Dhanbad, participated on deputation in the UNOP/IAEA/RCA-sponsored Regional Executive Management Seminar on the Application of Nucleonic Control Systems to Coal Processing Operations held at Mae Moh, Lampang, Thailand, during 28-30 November 1994. The seminar had participants from China, India, Philippines and Thailand, and was conducted mainly for updating awareness on the state-of-the-art position with respect to nucleonic control systems in coal processing operations with specific reference to on-line measurement of coal quality.

The knowledge acquired by Dr Narasimhan at the seminar would be of specific benefit to the ongoing project on augmentation of coal preparation facilities at CFRI, for

proper and adequate instrumentation. Possibility also exists to initiate a development programme with the concerned agencies in India and other countries (perhaps through REA/IAEA) for a system for instant non-destructive measurement of coal properties in static conditions applicable to bore hole coal core analysis. □

TRAINING COURSES

UNESCO-sponsored Regional Training Course on Herbarium Techniques and Curation

The importance of plants to the living world hardly needs any elaboration. The natural plant heritage is held in trust for the coming generations and it is the taxonomist who is best qualified to monitor the conservation status of communities, species and their genetic biodiversity. The need of correctly identified plant specimen as a voucher for all plant-based research is universally accepted and is the preliminary necessity. These voucher specimen should be put in a recognized herbarium. Thus herbaria serve as the custodian of enormous amount of data in the form of systematically kept specimens of plants at one place. In its efforts to develop well-trained manpower in this area, the National Botanical Research Institute (NBRI), Lucknow, organized 10-day regional training course on 'Herbarium techniques and Curation' from 28 November to 8 December 1994.

The training programme was sponsored by UNESCO, under the Botany 2000 Asia programme. During this course, one Indian and two foreign resource persons shared their experiences with 10 foreign and 22 Indian participants. The course was presided over by Dr

P.V. Sane, Director, NBRI, and inaugurated by Dr S.K. Jain, Emeritus Scientist, NBRI and ex-Director, Botanical Survey of India.

Speaking on this occasion, Dr Jain said that herbaria are collections of dried and systematically kept specimens of plants and serve as an essential tool in research on crude drugs, agricultural crops, medicinal and aromatic plants, horticulture and forestry. They provide basic data for studies on ecosystem, environment and herbal formularies. Narrating the history of herbarium, Dr Jain said that the first collection of dried plants was done exactly 450 years ago in 1545, which resulted in the establishment of first known herbarium in Padua in Italy. In India, the first herbarium was founded in Calcutta in 1793. He also spoke on plant nomenclature and type concept, and suggested for providing free access of students to some of the section of herbaria to create awareness about biodiversity amongst them.

Dr P.V. Sane, in his introductory remarks gave an outline of genesis of this training programme. He appealed to the taxonomists to make use of modern molecular techniques, like RFLP, DNA fingerprinting, isoenzyme patterns, etc. for the betterment of taxonomy, and also to attract the talented younger generation in this field. He also emphasized that these techniques could be useful in solving the problem of various complex taxa.

Dr R.R. Rao of NBRI, the convener of this course and one of the resource persons, gave an elaborate account of past and present concept and development of herbarium. He also dealt in detail about the existing biodiversity in India and role of herbaria in this aspect. Younger researchers working in this field should do floristic studies first and monographic/re-



Dr J.V. Kingston, Director, UNESCO, delivering his lecture at the Training Course on Herbarium Techniques and Curation. Also seen on the dais (from left) are: Dr R.R. Rao and Dr Neville Merchant

visionary studies thereafter, he suggested.

Speaking about the role and functions of herbaria, importance of taxonomists and various curatorial problems, Dr Neville Merchant, Secretary, Botany 2000 Asia Programme and a resource person from the Department of Conservation and Land Management, Australia, said that the facilities like computers would supplement the scope and function of herbaria which were the custodian of enormous amount of data.

Prof. Ruth Kiew, resource person from the Department of Biology, University of Pertanian, Malaysia, talked about the preparation for field collection and necessary precautions, important herbaria of the world and role of herbaria in conservation of biodiversity. Dr J.V. Kingston, Director, UNESCO, also spoke on the genesis of this training course.

Other distinguished speakers to the trainees were: Dr B.P. Singh, Senior Scientist, NBRI; Dr S.L. Kapoor, ex-Scientist, NBRI; Dr K.K. Singh, and Dr D.K. Upreti, Scientists of NBRI.

A field trip was also organized for the trainees to Kukrail forest, Lucknow, for exposing them to the various methods of plant collection including collection of special group of plants, such as aquatics, succulents, bulky fruits, palms, bamboos, etc.

A few recommendations were also made during course, which are as follows:

(i) Efforts should be made to increase the number of taxonomists, and an attractive career structure should be framed to attract high calibre 'new blood'.

(ii) Additional funding should be provided for computerization in herbaria, and computerization of data should be undertaken invariably by a scientist attached to the herbarium.

(iii) For making voucher specimens, the plant material preserved in recognized herbaria should be used, as a proper specimen the work is not reproducible and, therefore, not in line with scientific method.

(iv) The expertise of herbarium taxonomists in identifying the botanical specimens should be ade-

quately rewarded either in terms of co-authorship or in terms of providing funds for herbarium activities.

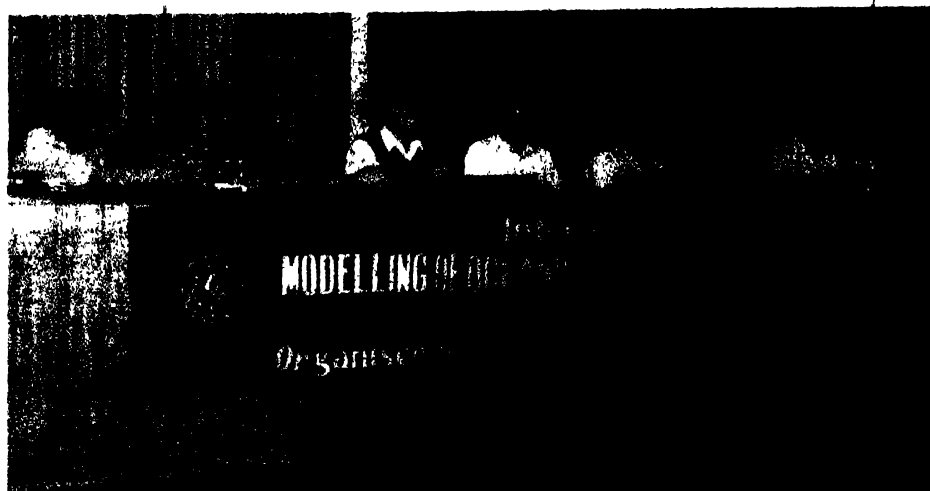
*Dr D. Upreti, ex-Scientist, NBRI
Rao-712258*

C-MMACS Intensive Course on Modelling of Oceanic and Atmospheric Processes

The Centre for Mathematical Modelling & Computer Simulation (C-MMACS), Bangalore, organized an Intensive Course on Modelling of Oceanic and Atmospheric Processes under the sponsorship of DST, during 7-17 November 1994. The course was attended by 30 participants.

Welcoming the participants, Dr K.S. Yajnik, Head, C-MMACS, explained the primary motivation behind arranging such a course, "what happens in the ocean or the atmosphere ultimately affects all of us; so there is a great need to study such phenomena. And because the ocean and the atmosphere are so big, any modelling exercise involving these entities will necessarily be under-sampled. To cover this shortcoming, good modelling with elaborate schemes, becomes very essential".

Dr K.N. Raju then inaugurated the Course and released the lecture notes. These notes had been prepared in a modular form and also contained a floppy disk of the text material. In his brief inaugural address, Dr Raju made an evocative reference to the effect of the "mountains in the north and the oceans in the south" on the Indian climate. Talking of the destructive power of earthquakes and the menace of cyclones "which the Bay of Bengal seems to be producing with great regularity", Dr Raju pointed out that modelling could prove to be an invaluable tool to understand the complex problems underlying non-linear dynamics.



appreciation certificate. It was presented to Dr Krishna Gopal by Shri Krishna Kumar, State Minister of Agriculture and Non-Conventional Energy, Government of India, during the symposium on 'Management of Ecosystem and Sustainable Utilization of Biological Resources' organized at College of Entomology, Kerala Agricultural University, Trivandrum. The symposium was jointly sponsored by Kerala Agriculture University and Academy of Environmental Biology (India). □

One of the important aspects of the course, assiduously organized for C-MMACS by Dr P. Goswami and his colleagues, was the quality of its faculty which included two experts from USA. □

pakesan, Deputy Director, NAL, was the course coordinator. □

Honours & Awards

Unix & C

The Intensive Course on Unix & C held recently at the National Aerospace Laboratories (NAL), Bangalore, marked debut of the new NAL/CTD initiative to reorient the activity of NAL's erstwhile Computer Centre towards high quality computer training and instruction. About 25 participants attended the 10-day course which included 40 hours of hands-on training.

Speaking at the inaugural function Dr K.N. Raju said that it was a good beginning "especially to start with Unix & C". Dr S.R. Valuri said it was the next "tryst with destiny" for NAL's computer professionals and Shri P.C. Nayak, Director, CTD, said that his dream of setting up a network of trained computer professionals had finally come true.

The course was organized by the NAL's Advanced Information Technology Centre (AITC) together with the Centre for Technology Development (CTD). Shri S. Pancha-

AEB Gold Medal to Dr Krishna Gopal

Dr Krishna Gopal of the Industrial Toxicology Research Centre, Lucknow, has been awarded Academy of Environmental Biology Fellow Award for the year 1993 in recognition of his outstanding contributions to the field of Aquatic Toxicology. The award consists of a gold medal and an

RRL - Bhubaneswar gets Rural technology award for developing energy-efficient multi-fuel chulhas

The Regional Research Laboratory (RRL), Bhubaneswar, has been working for the past few years on development of energy-efficient multi-fuel *chulhas*. Eight models in both portable and fixed types have been developed. These are *Harsha*, *Jyotsana*, *SK-1*, *SK-2*, *SK-3*, *SK-4*, *SK-Delux* and *SK-Agni*. All these are low-cost models with thermal efficiency ranging from 25 to 43% and



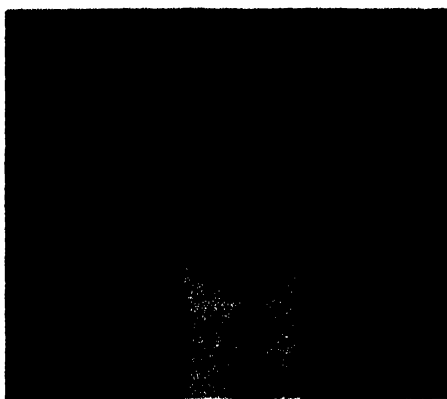
Shri S. Panchapakesan, Deputy Director, NAL, addressing the participants of the AITC/CTD course on Unix & C

are nearly smokeless. These are being propagated by the Ministry of Non-Conventional Energy Sources through Orissa Renewable Energy Development Agency.

The cheapest model, viz. *SK-Agni* is a mud clad structure with inner components made of mild steel with ceramic lining. The construction is very simple and maintenance free. Wood, twigs and agro-wastes singly or in combination can be utilized as fuel. It provides 29% thermal efficiency and effects 50% fuel conservation over the conventional country *chulha*. This *chulha* is being fabricated at a cost of Rs 50 and made available to the beneficiary at Rs 35 through MNES subsidy. Over 2 lakh such *chulhas* are being adopted every year in different rural areas. For this work the laboratory has been given Pam Davar Basu Award 1994, of Shri Ram Washeshran Devi Bhatia Memorial Charitable Trust, a New Delhi based philanthropic organization. The award carries a cash prize of Rs 25,000. □

Dr V.P. Dimri gets National Mineral Award

Dr V.P. Dimri, Scientist, National Geophysical Research Institute, Hyderabad, has been awarded the

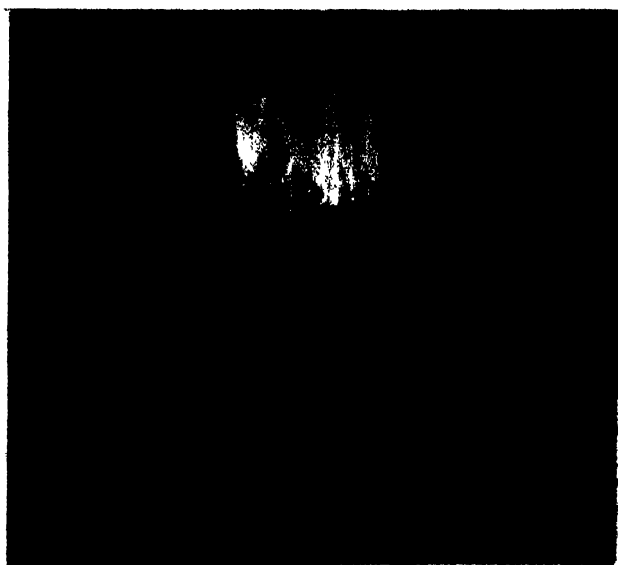


prestigious National Mineral Award for the year 1992-93 by the Ministry of Mines, Government of India, in recognition of the significant contribution made by him in the field of geophysical study by inducting innovative approach. The award carries a cash prize of Rs 12,500 and a citation. Dr Dimri received the award from Shri Balram Singh Yadav, Minister of State

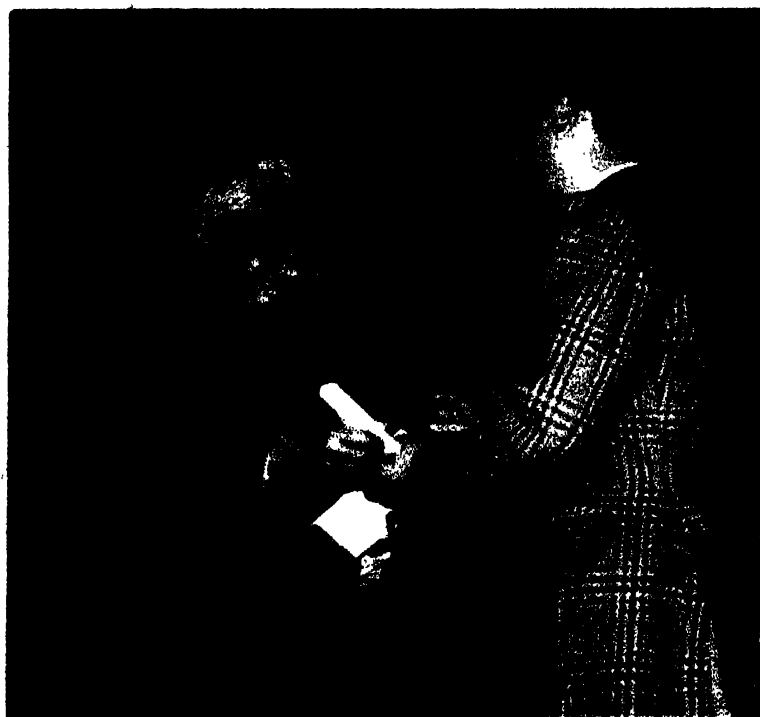
for Mines, on 20 December 1994 in New Delhi.

Dr Dimri has made remarkable contributions to the fields of seismic and potential methods for exploration of oil and minerals. His investigations include a discovery that a single channel time-varying deconvolution is equivalent to multichannel time-invariant deconvolution, design of adaptive deconvolution operator for analysis of marine seismic data over Arabian Sea, magnetization mapping in part of Bay of Bengal, development of high resolution maximum entropy and maximum likelihood methods for overlapped geophysical signals.

He has established parallelism between deconvolution and inversion, the two powerful and inevitable tools of geophysical data processing and interpretation. His novel approach of combining these approaches has opened a new field of research which has found wide recognition in scientific community.



SK-DeTux multi-fuel fixed *chulha*
Prof. H.S. Ray receiving the Pam Davar Basu Award-1994 from Shri K.R. Narayanan, Vice-President of India



Currently, Dr Dimri is studying the fractal geology and its geophysical response. He joined NGRI in 1970. He was deputed to Germany for 17 months for advanced study in geological sciences. He was selected through a world-wide competition for the prestigious Post Doctoral Award by the Royal Norwegian Council for Scientific and Industrial Research, Oslo, Norway, to work with a leading oil company for two years. He is an external member of board of studies and courses for Applied Geophysics, of the Indian School of Mines, Dhanbad and also a member of Programme Advisory Committee (Earth Sciences) of the Department of Science & Technology.

Dr Dimri has 35 research papers to his credit and written a book entitled *Deconvolution and Inverse Theory* published by Elsevier Science Publishers, Amsterdam, in 1992.

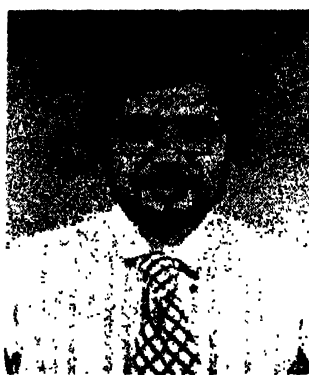
Dr. Rajiv Nigam
Geological Oceanography Division

Dr Rajiv Nigam of the Geological Oceanography Division, National Institute of Oceanography (NIO), Goa, has won the Krishnan Gold Medal for the year 1994, for his significant contribution to Geological Oceanography, particularly the micro-palaeontology. His studies have enhanced our knowledge on sea level changes and palaeomonsoon.

This gold medal is given by the Indian Geophysical Union in honour of Dr M.S. Krishnan, former Director General of Geological Survey of India.

Dr Nigam is recipient of the CSIR Young Scientist Award (1989) and National Mineral Award (1992). He has been to Oslo University (Norway) and Woods Hole Institute of Oceanography (USA), on NORAD and BOYSCAST Fellowships, to get himself acquainted with the advanced methodologies applied in micropalaeontological studies.

A recognized guide of the Goa and Allahabad universities for



M.Sc. and Ph.D. students, he is presently working on culture of foraminifera species, important in pollution and palaeoclimatic studies. He has over 50 research papers to his credit.

Dr Kotur S. Narasimhan

Dr Kotur S. Narasimhan, Director, Central Fuel Research Institute, Dhanbad, has been elected a Fellow of the Institution of Engineers (India).

Dr J.L. Jethwa

Dr J.L. Jethwa, Scientist-in-charge, Nagpur Regional Centre of Central

CBRI Extension Centre, New Delhi - New address

The Central Building Research Institute's New Delhi Extension Centre has been shifted from CRR, Mathura Road to the India Habitat Centre, Lodhi Road. The new address is as follows: CBRI Extension Centre, Zone 6, II Floor, India Habitat Centre, Lodhi Road, New Delhi 110 003; Telephone: 4632757 & 4632758.

Mining Research Institute (CMRI), Dhanbad, has been given the Khosla Research Award consisting of Rs 1500 and a silver medal.

CRRI Scientists get R.N. Prasad Biennial Award

Shri P.J. Rao, Shri Kishore Kumar and Shri Jai Bhagwan, Scientists of the Central Road Research Institute, New Delhi, have been jointly awarded the IGS-Shri R.N. Prasad Biennial Award for the year 1991-92 by the Indian Geotechnical Society (IGS) for their paper entitled 'Prognostication of Landslides in Himalayas' published in the journal of IGS.

COUNCIL OF SCIENTIFIC & INDUSTRIAL RESEARCH

(HUMAN RESOURCE DEVELOPMENT GROUP)

Advertisement No.SRF/RA-EMR-I/95

This is to bring to the attention of all concerned that CSIR has invited applications for awarding Senior Research Fellowships and Research Associateship vide an advertisement appearing in 21 January 1995 issue of *Employment News*. Eligibility conditions and application proforma are published alongwith the advertisement. The application form may be cut out or copied from the advertisement and used.

The last date of receiving applications is 24 February 1995. The application duly completed in all respects should be sent to the Deputy Secretary, Extra Mural Research Division, Human Resource Development Group, CSIR Complex, Dr K.S. Krishnan Marg, Pusa, N.P.L. Campus, New Delhi 110 012.

Printed and Published by Dr G P Phondke, Director, Publications & Information Directorate (PID), Dr K.S. Krishnan Marg, New Delhi - 110 012
Printed at PID Printing Unit

Editors : Dr B.C. Kashyap and Madhu Sahni

Phone: 5786301

Production : Kaushal Kishore

Gram: PUBLIFORM

Annual Subscription : Rs. 60

Telex: 031-77271

Single Copy: Rs. 3.00

E-mail: pid@slmetd.ernet.in. Fax: 5787062

CSIR

JOURNAL



VOL 45 NO 3 15 FEBRUARY 1995

IN THIS ISSUE

Leather Technology Mission Launched	34
Symposium on Collagen Structure, Biology and Technology	38
International symposium on Electrochemical Science and Technology	41
Indo-German workshop on <i>In vitro</i> technology	42
The Cyclone that is welcome	43
From steel mill slag to fertilizer	44

On the occasion of launching the Leather Technology Mission for Sustainable Development. On the date are (from the right) Dr. S.K. Joshi, Director General, CSIR, Shri Bhuvanesh Chaturvedi, the Minister of State for Science and Technology and Vice President, CSIR, Shri P.H. Mehtani, Chairman, Council for Leather Exports, and Shri S.D. Garg, Adviser (P & C), CSIR. (Below) An exhibit showing various types of finished leather produced by CLRI, Madras

Leather Technology Mission launched

LEATHER has established as an important foreign exchange earner for the country as well as a major contributor to socio-economic development. However, given the evolutionary history of the industry and the future expectations in a globalised economy and trade scenario, many critical gaps are discernible which need to be addressed early and effectively to ensure the Industry's sustained growth, nationally and internationally. In 1957 India's share in global trade in the leather sector stood at about nine per cent; it dropped to 2.7 per cent in 1991. The Leather Technology Mission Mode Project launched on January 12, 1995, by the Minister of State for Science and Technology and Vice President, CSIR, Shri Bhuvanesh Chaturvedi, aims to take the figure to 10 per cent by A.D.2000. The Mission Mode Project has also been formulated to foster and enhance the traditional and new skills of workers and artisans engaged in the leather sector, especially the tiny and small unorganised units, and promote their viable links with

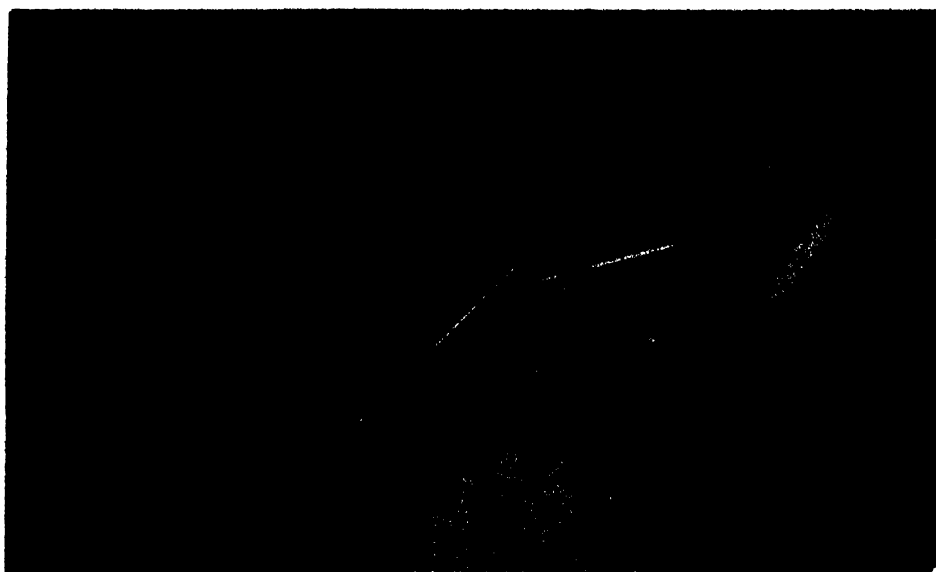
the organised sector. In this way it admirably complements the UNDP assisted National Leather Development Programme (NLDP) which was launched by the Government of India in April 1992.

The launching of the Leather Technology Mission Mode Project for Sustainable Development with the Council of Scientific & Industrial Research (CSIR) as the lead agency is an important event in the annals of the CSIR, and a highly commendable achievement for the Central Leather Research Institute (CLRI), Madras. On the occasion of the launching of the Mission Mode Project the Minister said, "Often, it is believed that Science and Technology and R&D institutions are ivory towers concentrating on the basic and fundamental research to meet the requirements of the elitist and higher echelons of the society. But the CLRI, the largest leather research institute in the world, right from its inception is actively involving itself for the development of leather industry, catering to the needs of tiny sector leather units at

the grass-root level and small and large scale units in the organized sector with all their diversities and magnitude of problems."

In his welcome speech, Dr S.K. Joshi, Director General, CSIR, said, "This launching of the Leather Mission opens a new chapter in the long history of CSIR. It is for the first time that the CSIR has seized an opportunity to launch a National Mission Programme." Highlighting the Leather Mission objectives, Dr K.V. Raghavan, the Mission Director and Director, CLRI, said, "Emphasis would be laid on the development of tiny and small sectors, as they are involved with the recovery of raw materials like goat and calf skins". P.H. Mehtani, Chairman, Council for Leather Exports, Madras, gave the Presidential address. Vote of thanks was given by S.D.Garg, Adviser (P&C) CSIR.

"The Leather industry had remained quite strong in the advanced countries of Europe and American continents till the beginning of this decade," continued the Minister. "But thereafter it has been declining in these countries due to the rising cost of wage bills and stringent environmental regulations. With the result, the advanced countries which are also major producers of hides and skins have now become major exporters of raw materials to the developing countries like China, India, Indonesia, Thailand, Vietnam, Pakistan and other countries in this region. Some of these countries have registered high growth rate of production during the last 3-4 years. However, India has been maintaining a slight but steady growth rate. The Government of India policies during the last four decades have greatly helped leather industry to attain a status of strength and to



Dr. S.K.Joshi giving the welcome speech on occasion of launching the Leather Technology Mission

provide employment to a large number of socio-economically disadvantaged people.

"Nevertheless, the Government has also allowed modern facilities to be set up within the country, if 75% of such production can be exported," continued the Minister, "The leather industry in India enjoys the multiple benefits in the form of liberalized import of capital goods, components, raw materials and consumables and other incentives. This export oriented modern production sector co-exists with the vast network of traditional production units for leather and leather products. The National Leather Development Programme (NLDP) of the Government of India has given an integrated thrust to the leather product sector for promoting more rapid growth in exports. It is the objective of this leather technology mission to integrate the small scale and traditional production units to those in export sector. The co-existence is for their mutual benefit and special emphasis has been placed on technology upgradation in the traditional production sector."

"The leather Industry in the country and the Central Leather Research Institute (CLRI) since its inception in 1953, have worked in tandem," added Dr Joshi, "A phenomenal growth of 100 fold in export earnings in the leather sector has been achieved during the last 40 years. Many milestones have been crossed by the industry and the CLRI has made significant contributions in this journey of progress by industry. In this process CLRI has gained the trust of the Industry."

"The Leather Technology Mission has several unique features," continued Dr Joshi, "Leather industry is dominantly a small scale one providing employment to about 1.5 million people. Technology extension is the backbone of the mis-

sion. A number of demonstration units on leather processing, effluent treatment plants, leather complexes will be set up during the course of next four years. Training programmes for human resource development will also be taken up. The beneficiaries ranging from rural artisans to technicians will be trained. This will not only improve the quality of products and increase exports but also improve the economic condition of leather workers. We shall suggest flexible organizational models for restructuring of the industry dispersed all over the country."

One aspect which deserves appreciation is that the Mission activities cover almost all the states in the country with programmes that are relevant to a particular location. Special attention has been placed on the upgradation of leather process technology for improving the productivity of the working personnel and inplant ecology for minimizing occupational health hazards. The mission aims at promoting the role of women in manufacturing activities at household and factory levels through appropriate HRII and facility upgradation programmes. It also recognises growing need for the rapid modernization of the tanning sector and lays stress on the organizational aspects of the leather sector and several models are likely to be tried for their relevance to the prevailing ground situation in various states. "While appropriate focus has been laid on the tanning sector in this mission, I would suggest that equal attention may be paid to the development of leather product sector in selected areas where rural artisans, women and other socio-economically weaker sections of our society can be assisted", added the Minister.

Other Government organs involved in the mission include the

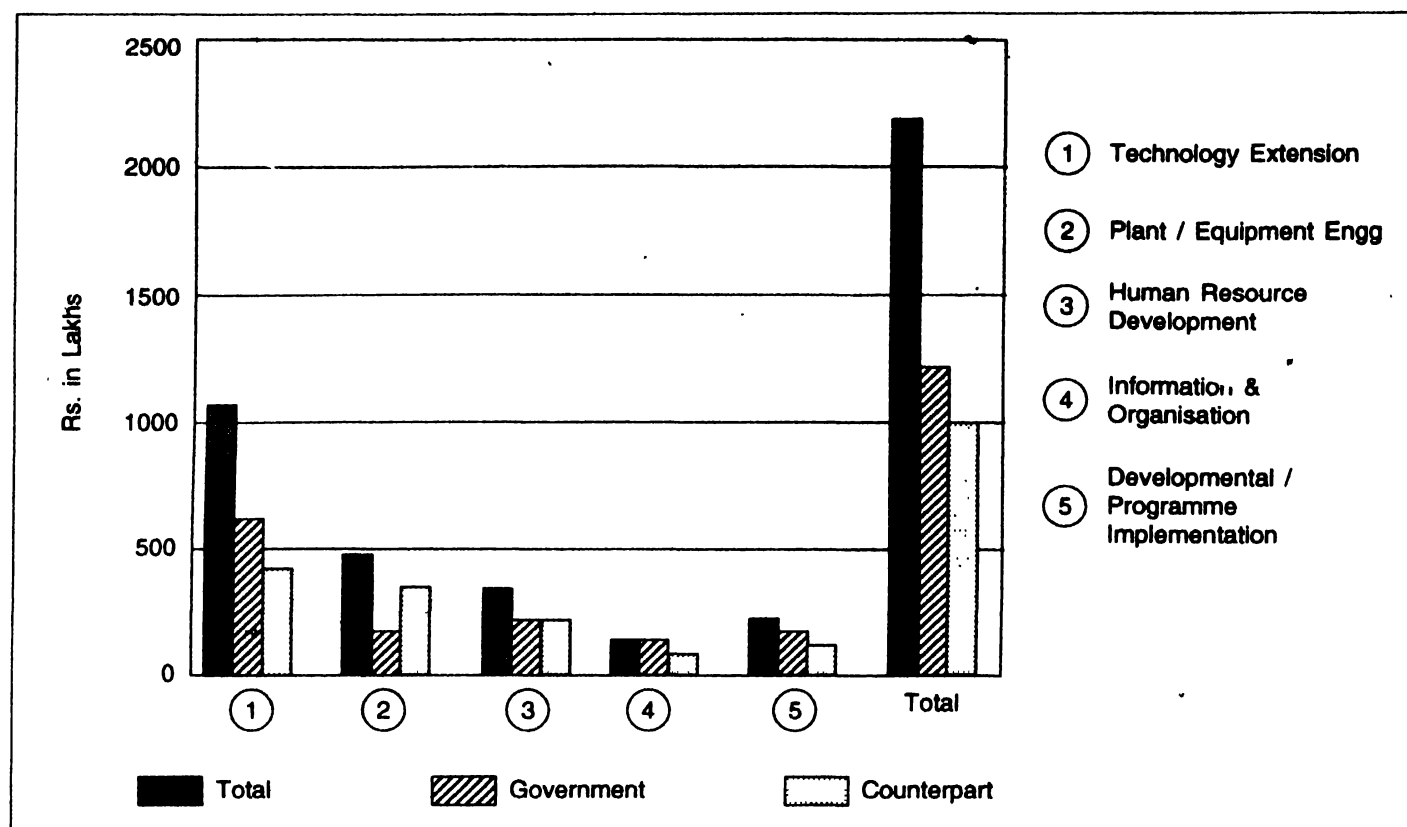
The Leather Technology Mission objectives:

- To augment the availability of quality hides and skins.
- To demonstrate the use of technology as a grid for balanced development of the leather sector.
- To provide extension services to rural and small industry in the adoption of cleaner technologies and upgradation techniques.
- To spread awareness of quality and standardization in the wider leather sector.
- To demonstrate harmonious blending of traditional and new skills through innovative training and pilot programmes.
- To implement and assess technology delivery systems most suited for the Indian leather industry.
- To study and identify the most suitable organizational structure(s) to integrate the development of rural, semi-urban and urban sectors in leather.
- To catalyse the enhancement of the share of Indian leather products in global trade to 10 per cent.

Planning Commission, the Department of Science and Technology, Department of Biotechnology, and Scientific and Industrial Research, and the Ministries of Finance, Human Resources Development, Industry, Agriculture, and Rural development.

Rationale for the mission

In just four decades since Independence, India has made significant gains from the leather trade, progressing from the status of an exporter of raw hides and



Budget allocation for Mission Project

skins to that of an importer of leather goods and a predominantly leather product manufacturer. This is not a small achievement, thanks to concerted thinking and action by the enterprising leather industry, the internationally renowned CLRI and imaginative governmental policy makers. This success is the envy of many nations.

Buoyed by good past performance and encouraged by expanding world market for leather articles, India has set its sight on a 10 per cent of share of the global trade by the year 2000, which would mean more than a three-fold increase from the present three per cent. Earning foreign exchange apart, such a trade expansion would mean generation of substantial employment, skill building, entrepreneurship development and widely spread socio-economic

benefits. For India, therefore, the growth of the leather industry is a direct contribution to rural advancement and socio-economic development.

Expansion of leather industry raises several issues relating to sustainable development encompassing the structure of the industry in the country, raw materials, ecology and environment, technological dynamics, market factors and so on. Strengthening the indigenous base has been a main objective of the various recent national initiatives on leather in the country. For example, the National Leather Development Programme (NLDP) concentrates on bridging those critical gaps where adequate competence does not exist in the country and which need external assistance to strengthen the ability of the cottage, rural and small scale sectors to cope with technological

changes and to integrate them efficiently in the overall development of the industry. This technology driven development grid for the Indian leather sector thus aims to augment raw material availability, upgrade technology, promote cleaner technologies and standardize quality and develop organisational and human skills in a significant measure to generate multiplier effects.

Raw material availability

The increasing tempo of development and rising trend of incomes have not only boosted the domestic consumption of leather and leather products but has also led to rapid changes in fashions and quality consciousness in India. A phenomenal growth rate of 28 per cent was witnessed by the Indian leather sector during the VII Plan period. But the (projected) growth

rate of VIII Plan had to be lowered to a modest level of 16 per cent per annum for the sector as a whole and 18 per cent for the export category due to raw material crunch. India possesses the highest livestock population in the world though the growth rate of the same is comparatively low. Some Indian raw materials like goat, calf and red hair skins are speciality items and command good market.

A good deal of hides and skins are wasted due to non-recovery of the fallen animals, faulty transportation, improper flaying techniques, etc. A CLRI (1986) study estimated a loss of about Rs. 660 crores per annum due to non-recovery of hides and skins as also non-utilisation of by-products. The global leather industry also depends on low-wage developing countries thereby increasing the demand for raw hides and skins in the country.

India has not been able to take advantage of this situation in the global leather trade which is growing at the rate of 10 per cent per annum, because in spite of increasing exports, India's share in global trade in leather sector has declined from about 9 per cent in 1957 to 2.7 per cent in 1991. The domestic consumption reached Rs. 2,740 crores in 1991-92 whereas the export was about Rs. 3,200 crores. The export targets also increased pushing leather sector up as the fourth largest foreign exchange earner. Reaching a production target of Rs. 20,000 crores and export target of Rs. 10,000 crores, or 10 per cent of the global trade in leather sector, by the year A.D. 2000 seems an uphill task unless some vigorous and concerted efforts are made.

Technology upgradation

The present structure of the Indian leather industry poses many diffi-

culties for the rapid and balanced growth of leather product sector needed to achieve the projected production targets.

Of the 1083 tanneries existing in the country, 88 per cent are in the small scale sector. Most of these units do not have a viable size for investment in sophisticated plant, machinery, process control mechanism or in-house R&D. Technological upgradation is required to cover the whole spectrum of improvement in hides and skins through improved animal health and biotechnological inputs, upgrading the carcass recovery centres, standardisation of components, supply of improved tools to artisans for making quality leather products such as shoes, garments and leather goods. Design and quality are also neglected aspects. Upgraded testing facilities, quality standards and training programmes are required.

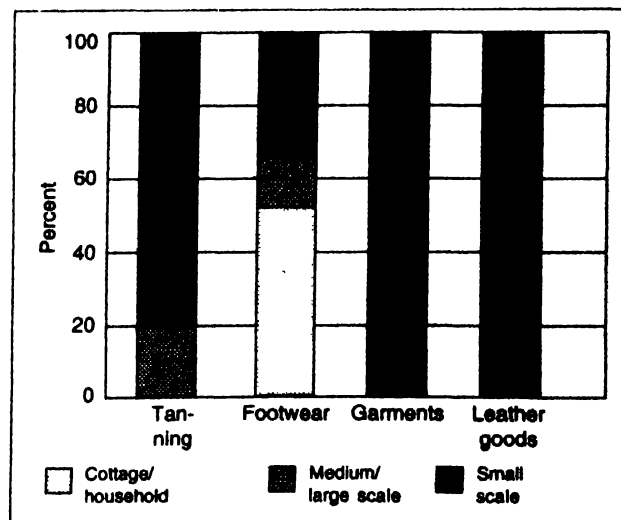
Eco-friendly technologies

Pollution control and occupational safety in this industry need priority attention. In the tanning sector, the operations such as washing, stripping, bleaching, chrome tanning, basification, retanning, dyeing and fat-liquoring produce waste water streams such as the soak liquor, sulphide-bearing lime liquor, and chrome-bearing tan liquor. Some of these chemicals are toxic, pollute groundwater streams, create nuisance to the local inhabitants and threaten the image of leather industry in the eyes of foreign buyers. CLRI is now offering many ready-for-use green

technologies for the leather sector such as saltless curing, mechanical desalting, enzymatic dehairing, CO₂ deliming, optimisation in use of chemicals with accent on efficient use of water and energy mechanisms, material handling devices and reduced use of chrome. In short, it offers cleaner technologies with significant economic benefits as well.

Organizational models

Vertical integration of the leather product sector is weak in the country and is only slowly developing now. Most of the tanneries are concentrated in Tamil Nadu (579), West Bengal (233) and Uttar Pradesh (147). The footwear sector is concentrated in Agra, Ambur and Kanpur and leather goods sector in Calcutta while leather garments manufacturing sector is emerging in Bangalore, Bombay and Delhi. Historically leather processing was concentrated near the coastal cities for the ease of exporting the raw materials. Footwear units were set up mainly in Agra and Kanpur for meeting the Imperial army and police demands. In a sense, the leather industry got alienated from domestic and civil-



Structure of the leather industry

ian markets. Moreover, this sector could not hold any reinforcing influence on agricultural sector as the tanneries were not established close to the region where animal husbandry was developed. Such rationale is no longer valid in the post-colonial era, given the need for organizational change, among other things.

In the last two decades, there has been a relative growth of skills and technology upgradation in the industry as a whole. However, it seems to have left no imprint in the rural and cottage industries, despite the fact that the leather industry as a whole is dependent on the rural sector for its raw material supply. Furthermore, due to increasing demand for the raw material in the urban and semi-urban industries with their semi-mechanised and mechanised units, raw material for the rural and cottage industry is becoming scarce. It is obvious that the integration of all the sectors can result in enhanced productivity, quality and income levels of rural artisans.

Quality standardization is relevant not only to rural and cottage sectors but to urban domestic and export sectors as well. Upgradation of skills and quality consciousness have to be brought about by systematic training of personnel at all levels, both rural and urban.

Upgradation of human skills

The total employment generated by this sector is about 14 lakhs. Of this, 6 lakhs are engaged in flaying and recovery. However, most are part time workers in rural areas and lack proper training for the job. Untrained practices often turn out damaged hides and skins. Nearly 7 lakhs are engaged in cottage and small scale industries and only one lakh in medium and large scale units. Adequate training facility

does not yet exist in the country for technical manpower needed by modern or cottage industry sector. The reasons for this are many, the important among them being the social prejudice against this profession. Though employment of women is very high in the product sector in certain parts of the country, a negligible proportion of women are found at supervisory or managerial level. Moreover, the technological changes in the near future are likely to threaten the employment of women in certain female dominant operations.

The upgradation of rural artisans' skills is also important if they are to be integrated into high quality, high priced domestic and export markets.

Expected benefits

This mission mode project aims at demonstrating the benefits which can accrue through technology inputs, extension and promotional activities. An investment of Rs. 12 crores is expected to bring five fold returns. This will be a catalytic phase for the industry with a strong multiplier potential for the future.

The likely benefits of the thrust provided by this mission are not simply in economic but also in social and environmental spheres. Efficient carcass recovery will not only reduce losses but also facilitate the availability of cheap leather to rural artisans. Similarly, by introducing advanced split

leather finishing, the resource augmentation is likely to be of the order of 1.9 crore.

Success in this mission can generate additional employment to at least five lakh persons. In addition, the industry will also benefit by way of upgraded training and qualitatively superior technical manpower.

Newly available and proven technologies, such as, microprocessor based tannery wet operations and cleaner processing are not only expected to enhance quality and consistency, better image and additional revenue but also non-economic benefits such as abatement of land and water pollution, better work environment and occupational safety.

Packages proposed to be provided for better organisational and layout facilities are expected to add not only to productivity but also quality. The integration of rural artisans through improved training and techniques are expected not only to help meet the demands of domestic as well as export markets but also add to their income significantly.

It is also anticipated that the Indian leather exports will grow at such rates that the total realization of foreign exchange from the industry in A.D. 2000 would reach \$4 billion at the current exchange value. This implies an additional revenue of approximately \$1.5 billion in excess of the VIIIth Plan targets. □

Symposium on Collagen Structure, Biology and Technology

A symposium on Collagen Structure, Biology and Technology was recently held at the Central Leather Research Institute (CLRI), Madras. Attended by over 120 scientists from USA, UK, Canada, Belgium,

Italy, Japan, Czechoslovakia, South Africa and India, the symposium was a satellite meeting of the 16th International Congress of Biochemistry and Molecular Biology held later in New Delhi.

The symposium began with welcome address by the CLRI Director Dr K.V. Raghavan. This was followed by reading out of a message of Dr G.N. Ramachandran, the propounder of triple helix structure of collagen, who could not attend the symposium owing to ill health. Dr R.S. Bhatnagar of USA and Dr M. Adam of Czech Republic also spoke on the occasion. Dr G. Thyagarajan released a colourful souvenir brought out on the occasion. Dr S. Ramachandran, former Secretary, Department of Biotechnology and the Chairman, Research Council of CLRI, delivered the presidential address. Dr S. Varadarajan, Chairman, Vaccine Research Corporation, inaugurated the symposium. Dr Gowri Chandrakasan proposed a vote of thanks.

The inaugural function was followed by five technical sessions.

SESSION 1: STRUCTURAL BIOLOGY OF COLLAGEN

This session was chaired by Dr E. Subramanian and Dr D. Woolley.

Dr R.S. Bhatnagar presented results of his investigations on the surface structure of collagen, using scanning tunnelling microscope and the atomic force microscope

(AFM). The AFM pictures indicated certain charged residues spread on the collagen. He also reported isolation of a peptide sequence of about 15 peptides forming a beta-sheet in the structure and this may be the location where cells attach themselves to collagen through their receptors. These peptides when synthesized *in vitro* and located into polyester matrices were capable of attaching cells to them.

Dr D. Hulmes presented his work on the structural organization of collagen molecules in fibrils with respect to the cross-section of fibrils. He showed the low-angle X-ray diffraction picture of collagen marked by the presence of discrete but diffuse spots in the equatorial pattern which has not been hitherto explained. The X-ray diffraction pattern was explained satisfactorily by computer simulation of packing order and the presence of 'holes' and 'overlap' regions of the five-stranded and six-stranded microfibrils.

Dr A. Colombatti from Italy spoke on Type VI collagen. He reported his study on the expression of Type VI collagen in embryonic tissue as well as cells in culture. According to him, in culture the expression of Type VI increases for

two days and then falls off in 14 days. The mRNA levels corresponding to different collagen types were also determined. The cell adhesion to Type VI collagen was ascertained and it was found that Type VI collagen with molecular weight of 2000,000 is more effective in cell adhesion while the 500,000 molecular weight pepsin-purified Type VI collagen is less capable of binding cells.

Dr K. Sato explained that the collagen usually has three helical alpha-chains in its structure. He reported a type of collagen which has a different type of alpha-chain. In fish Type V collagen is present to the extent of 5-10%. This can be purified and subjected to gel electrophoresis when the subunits can be separated. The chains correspond to $1(V)$, $2(V)$ and $3(V)$. The $2(V)$ chain protein was separated and further purified by HPLC. It separated into two distinct $2(V)$ and $4(V)$ chains which differed in primary structure. It is concluded that fish Type V collagen consists of $1(V)_2$ and $2(V)$ and also $1(V)$, $3(V)$ and $4(V)$ molecules.

Dr Gunwar Sripad in his talk touched upon the Type IV collagen which exists as a supramolecular structure in the lens and renal basement membranes. LBM was excised with *Pseudomonas aeruginosa* elastase to cleave collagen IV that retain both NCI and truncated triple helical domains. The nature of these two were dealt in some detail.

Dr Gowri Chandrakasan in her talk touched on the nonenzymatic glycosylation-induced changes *in vitro* in some molecular parameters of collagen. The changes in the molecular parameters such as viscosity, thermal stability, electrophoretic mobility and solubility, of non-enzymatically glycosylated collagen were determined *in vitro*. Detailed studies indicated that glycosylation affects the mo-



Seen on the dais during the Satellite Symposium on Collagen Structure, Biology and Technology (from left) are: Dr Gowri Chandrakasan, Dr M. Adam, Dr G. Thyagarajan, Dr S. Ramachandran, Dr S. Varadarajan, Dr K.V. Raghavan, Dr R.S. Bhatnagar and Dr D. Woolley

lecular interactions as well as crosslinking collagen.

SESSION II: COLLAGEN IN HEALTH AND DISEASE

The session was chaired by Dr Rajendra Raghov and Dr A.N. Chandrasekaran.

Prof. B.V. Nusgens dealt with the types of collagen that are normally encountered in Ehlers-Danlos Syndrome (EDVIIC). He explained how EDVIIC is similar to animal dermatosparaxis. The processing of procollagen type I and the production of PCP-N-I were investigated in normal bovine, normal human, dermatosparactic bovine and EDVIIC human skin fibroblasts. Prof. Nusgens showed that monolayer fibroblasts do not release PCP-N-I activity and barely process collagen precursors. Dr N. Giri dealt at length of the interstitial lung fibrosis (ILF) and explained how ILF is characterized by an excess number of fibroblasts, an absolute increase in lung collagen and deposition of highly crosslinked collagen fibrils resistant to enzymatic degradation.

He concluded his lecture by saying that the combined treatment with taurine and niacin has therapeutic potential in the intervention of development of chemically induced ILF in animals and humans.

Dr R.H. Nagaraj explained in detail the charges occurring in extra cellular matrix with relevance to less protein. Mentioning about the relationship between long term glycaemic control, polyol pathway activation and advanced glycation reaction in dura mater collagen of diabetic and galactosemic dogs, he showed that sorbinil treatment results in the enhanced synthesis of fluorescent compounds and pentosidine, and suggested that advanced glycation and crosslinking in

collagen are directly related to the degree of glycemia in diabetes.

Dr A.P. Jayaraj spoke on collagen degradation in aortic aneurysm induced by cysteamine and explained how aortic aneurysm could be prevented by essential fatty acids. In his lecture on 'Hepatocyte Matrix Interactions', Prof. P.R. Sudhakaran dwelt at length on basement membrane collagens. The easy availability of hepatocytes and their ability to attach and spread on collagen and noncollagenous basement membrane compounds *in vitro* make it an attractive model system. He showed that the extracellular matrix could regulate its own composition.

Prof. K. Shivakumar explained the various facets of endomyocardial fibrosis (EMF) and its relevance to collagen metabolism. He concluded his lecture by speculating that low levels of cerium might modulate expression of collagen in heart in EMF.

Dr A.V. Lakshmi explained the studies carried out on rats showing reduction in the content and maturity of skin collagen due to riboflavin and pyridoxine deficiencies.

SESSION III: MOLECULAR BIOLOGY OF COLLAGEN SYNTHESIS & ASSEMBLY

Dr M. Lapiere and Dr A. Colombatti chaired the session.

Dr Arthur Veis presented a paper on 'Biosynthesis and Assembly of Procollagen I Molecule : Chain processing and folding'. According to him, assembly of collagen molecule is a complex process requiring interaction of the three nascent chains and their subsequent folding within endoplasmic reticulum. The heterotrimer requires the parallel translation of pro $\alpha_1(1)$ and pro $\alpha_2(1)$ MRNAs. The nascent chains should be prevented from misfolding prior to triple helix formation. Dr Raghov presented his work on

complex transcriptional and post-transcriptional regulatory mechanism of Type I collagen biosynthesis *in vitro* and *in vivo*. He explained that collagen gene is regulated developmentally in a tissue specific manner. There are biological and pharmacological inducers for collagen gene expression. Molecular dissection of the regulatory sequences involved in the transcriptional and post-transcriptional processes of the human and murine pro α_1 collagen chains have unravelled the presence of the *cis*-acting elements located upstream of the site of initiation of transcription and in first intron. Regulation of pro collagen gene expression in a variety of mesenchymal cells in tissue culture and in transgenic mice indicates a paradoxical role of first intron.

Dr Parker discussed the transcriptional regulation of human pro collagen gene pro $\alpha_2(1)$. He talked about *trans*-acting factors and the factors responsible for inactivation of gene in cells not producing Type I collagen. Site-directed mutagenesis of promoter/CAT constructions revealed that these factors interact with each other as either activator/co-activator or activator/repressor, depending on cell type. This repressor could play an important role in tissue and cell-specific expression of collagen gene and may be important in collagen synthesis during wound healing and cancer metastasis.

Dr Reza I. Bashey talked about increase in collagen synthesis and gene expression in cultured fibroblasts from hypertrophic myocardium. Different models to produce cardiac hypertrophy were explained. These fibroblasts exhibited an increase in the collagen synthesis. Both Type I and Type III collagen mRNAs were over expressed. These studies will be useful in determining the regulation of expression of genes for various

connective tissue components in myocardium.

Dr V. S. Ananthanarayanan discussed the structural studies of enzymes involved in collagen biosynthesis and degradation. He had used synthetic peptide substrates for prolyl hydroxylase, lysyl hydroxylase and collagenase. The structural information was related to kinetic parameters for the interaction of peptides with purified enzymes. Models were proposed for the active site.

Dr David Hulmes talked about biosynthesis and distribution of TRAMP (tyrosine rich acidic matrix protein). A 22K protein, it co-purifies with lysyl oxidase, and plays a role in cell adhesion. It is widely distributed in tissues and has a number of possible functions.

SESSION IV : MOLECULAR MECHANISMS OF COLLAGEN DEGRADATION

The session was chaired by Dr D. Hulmes and Dr Malathi Madhavan.

An overview of the immunological events and the agents that bring about inflammation of the tissue in rheumatoid arthritis was elaborated by Prof. A.N. Chandrasekaran.

Dr D. E. Woolley in his talk brought out the nature of enzymes which may be involved in degradation of the connective tissue. Metalloproteinases such as collagenase, stromelysin and gelatinase secreted by fibroblasts and chondrocytes degrade proteoglycans, collagens I-IV, fibronectin and elastin. Trypsin and chymase secreted by the mast cells were shown to be the most potent agents in bringing about degradation of the matrix directly or in an indirect manner by activating the precursor forms of the collagenase and stromelysin.

Dr Lapiere described the differences in expression of collagenase in the monolayer of fibroblasts and that in the presence of fibrillar collagen or the growth factors such as epidermal growth factor, IL₁ or TPA. The tri-dimensional freely retracting collagen fibres as substrate for cells was shown to stimulate the collagenase secretion to the maximum extent. The role of tyrosine kinases and phospholipase C in participating the production of collagenase was also explained.

Dr V. Hanumantha Rao spoke on the expression of 72 KDa and 92 KDa Type IV collagenase from human giant cell tumor of bone (GCT) *in vitro*. It was reported that in the early passage of GCT both 92 KDa and 72 KDa collagenases are produced whereas cells at the late passage shows the presence of only 92 KDa Type IV collagenase, suggesting that 92 KDa proteins may play an important role in the malignant behaviour of the GCTs.

SESSION V : BIOTECHNOLOGY AND BIOMEDICAL ASPECTS OF COLLAGEN

The session was chaired by Dr S.N. Giri and Dr K.P. Rao.

Dr M. Adam presented studies on the implantation of collagen gels supplemented with the tripeptide Gly-His-Lys. While collagen gel

alone could promote proliferation and differentiation of the cells necessary for new bone formation, the above tripeptide accelerated these processes, and hence the maturation of the bone tissue.

Dr Christina Hamilton reported that one of the peptides prepared from collagen by enzymatic degradation, which was hydrophobic in nature, exhibited chemotactic migration of fibroblasts *in vitro*.

Studies on the activation of blood platelets in the presence of collagen presented by Dr Jamaluddin indicated that the activation pathways are not dependent on cyclo oxygenase metabolites.

Dr Rajamanickam dealt with the relationship between the isoenzyme change and proto-oncogene expression in cardiac muscle. The expression of proto-oncogenes, MLC 2 and c-fos are differentially regulated in cardiac muscle during normal development and myocardial hypertrophy.

Dr M. Adam presented the results of his studies on the effect of calcitonine (CR) treatment with and without collagen hydrolysate rich diet on urine pyridinoline excretion in over 100 persons with postmenopausal osteoporosis.

In addition, 32 presentations were made in the poster session. □

International symposium on Electrochemical Science and Technology

THE Society for Advancement of Electrochemical Science and Technology (SAEST) in collaboration with Central Electrochemical Research Institute (CECRI) and Southern Petrochemical Industries Corporation Ltd (SPIC) organized the Fifth International Symposium on 'Advances in Electrochemical Science and Technology' during 24-26 November 1994 at Madras.

The symposium was attended by more than 350 delegates, including 20 from abroad. Delegates from USA, Japan, U.K., Germany, France, Yugoslavia, Poland, Belgium, Portugal and Singapore actively participated in the symposium.

The symposium was inaugurated on 24th November 1994, by Dr H.V.K. Udupa, Former Director,



Prof G. V. Subba Rao, Director, CECRI, and Chairman Organizing Committee giving the welcome address at the Fifth International Symposium on Advances in Electrochemical Science and Technology

CECRI. In his inaugural address, Dr Udapa paid rich tributes to SAEST for having arranged many national symposia and workshops on specific topics and four international symposia. He also highlighted the scope that exists in various important areas in electrochemical science and technology. He also said that great attention should be paid to new techniques for understanding electrode processes and electrocatalysis. He emphasized that a new R&D approach should be thought of to improve manufacturing base of the country.

Prof. G. V. Subba Rao, Director, CECRI, and Co-Chairman Organizing Committee, while welcoming the eminent electrochemists, enumerated in great detail the activities and achievements of the Central Electrochemical Research Institute in the multifarious disciplines of electrochemistry. In his Presidential address, Dr A.C. Muthiah, President, SAEST and Vice Chairman and President SPIC commended CECRI for having done wonderful work in commercialising many processes like TSA, Calcium gluconate, etc. He was keen that Indian scientists should

work in highly competitive fields and excel in them.

Dr C.H.Krishnamurthi Rao, President, Alkali Manufacturers' Association of India and Chairman, Chemfab Group, Madras, declared open the Electrochemical Industries Fair. Shri S. Ramalingam, Chairman & Managing Director, Madras Refineries Ltd, Madras, released the video cassette on CECRI capabilities and achievements in Tamil. Dr K.S. Rajagopalan, former Director, CECRI, and Vice President, Technology Advancement Centre, Madras, released the souvenir brought out for the occasion. Dr N.Venkatakrishnan,

Secretary, SAEST, proposed a vote of thanks.

The technical sessions consisted of keynote lectures, invited lectures and contributory papers: (i) Oral presentation and (ii) Poster presentation.

Prof. S.K. Rangarajan, Chairman, Scientific Committee and Senior Professor, the Institute of Mathematical Sciences, Madras, and Dr C.G. Michael Quah, Dupont-BAFION, USA, gave the keynote lectures on "Modelling

electrochemical interfaces" and "Polymers in electrochemical technologies - some perspectives" respectively. Eminent scientists of international repute gave invited lectures on the following topics which were followed by lively discussions: (a) Fuel cells for the 21st Century; (b) Spatial variations in electrochemical reaction dynamics; (c) Conducting polymers; (d) New electroanalytical methods for trace analysis; (e) An overview of recent coating systems and their performance in marine environment; (f) Biocorrosion and biofouling; (g) Materials for solid state batteries; (h) Solid oxide fuel cells for clean and efficient power generation; (i) Surface engineering of aluminium alloys; (j) Modern trends in corrosion control and monitoring; (k) Fuel cells-R&D scenario in India; (l) Biofouling and harbour water corrosivity; (m) Trends in conducting polymers; (n) Energy reduction in chlor-alkali industry and future prospects; (o) Pollution control and some aspects of ODS and CETP; (p) Trends in plating technology; (q) Developments of aluminium production technology; (r) Recent trends in the syntheses of electrochemicals; and (s) Progress in extractive metallurgy of titanium and magnesium in India. □

Indo-German workshop on *In vitro* Toxicology

THE Industrial Toxicology Research Centre (ITRC), Lucknow, organized an Indo-German Workshop on *In Vitro* toxicology during 7-9, November 1994 under the Council of Scientific & Industrial Research (CSIR) - Forschungszentrum für Umwelt und Gesundheit GmbH (GSF) Agreement. The workshop reviewed the current status of research in *in vitro* toxicology in

India and Germany, including cell culture systems being used for toxicology research and testing. Identified needs of further research, and exposed young researchers to current approaches in this area and discussed alternatives to animals in toxicology. Twenty trainees from different parts of India attended the workshop. The faculty comprised experts from India and Germany.

The workshop focussed on the use of established cell lines in toxicological studies, *in vitro* systems for mechanistic studies, applications of *in vitro* systems for metabolism and mechanisms of actions of drugs and chemicals, neurotoxicology, *in vitro* test system for screening of genotoxicity, genetically engineered cell lines for toxicology, *in vitro* systems for hepato and reproductive toxicity. Laboratory demonstrations were arranged on maintenance and use of cell lines, applications of organ explants in *in vitro* studies, use of neuronal cells, reproductive toxicity assays and immunotoxicity techniques, in which trainees actively participated.

Dr S.S. Agarwal, Director, Sanjay Gandhi Post Graduate Institute of Medical Sciences, Lucknow, while inaugurating the workshop emphasized the use of *in vitro* toxicology and said that *in vitro* test systems work out to be much cheaper than the whole animal experimentation. He further said that the *in vitro* test systems are very useful to scientists for understanding the mechanistic aspects of various xenobiotics and drugs. However, the limitations of such systems should be fully understood.

Prof S.C. Agarwal, Former Director, Sher-e-Kashmir Institute of Medical Sciences, Srinagar, referred to the complexity of various toxicological problems and need to further explore ways to understand

the causative factors and the way they interfere with the biological system. He appreciated the organization of the workshop which, he said, should enlighten the trainees to the *in vitro* techniques currently being used both in India and Germany in toxicological research and testing.

Earlier, Dr R.C. Srimal, Director, ITRC, welcomed the guests and trainees and briefly described the expertise developed by ITRC in the use of *in vitro* techniques in R&D activities and safety evaluation of chemicals. He said that while the *in vitro* test systems offer several advantages, such as, they are simple, quick and cheaper, they cannot completely replace the whole of animals studies in toxicology research and testing.

Dr A. Chakraborty, Scientist, International Scientific Collaboration, CSIR, gave a brief account of CSIR-GSF cooperative activities and the initiatives taken by Dr S.K. Joshi, Director General, CSIR, to promote activities under the CSIR-GSF agreement.

Dr P.K. Seth, Deputy Director, ITRC, gave the genesis of the workshop and stressed the need of *in vitro* test systems in the present context. He said that the cell lines, isolated cells and organ explants and other techniques offer several advantages over the whole animal experimentation. Among these the foremost is that they allow comparisons of the effects of cellular and organ exposure to chemicals to be extrapolated across species to include man itself through the use of human cell cultures from biopsy material. In other words, cell culture techniques can permit the toxicological evaluation of compounds in animals and man on equal basis, which cannot be achieved in classical *in vivo* toxicological testing. Besides, use of cell culture permits inter-laboratory comparison nationally and inter-

nationally, has the potential to provide quick information, and the system is much cleaner and much less expensive. On ethical grounds also cell cultures are more acceptable. In his address Dr H.J. Hamann, International Officer, GSF, Neuherberg, Germany, said that he is extremely happy that it has been possible to hold this workshop under the CSIR-GSF cooperative agreement. He hoped that scientists from Germany and India would be able to identify some joint research programmes in areas of mutual interest during the workshop.

A problem solving session and a panel discussion for the benefit of the trainees to identify the scientists and the joint research work to be undertaken were also held during the workshop. Five proposals for collaborative research work were developed in the area of *in vitro* toxicology to be pursued between India and German scientists. □

The cyclone that is welcome

CAN a dreaded thing for the agriculturist be welcomed by the industrialist? Cyclone is one such thing with the condition that it should happen in a furnace.

Cyclone type furnaces are known for their versatility for efficient combustion of solid, liquid and gaseous fuels. Such a combustion system is particularly suitable for burning high ash non-cooking coal and has proved its utility elsewhere in the world.

In a cyclone furnace, the fuel and combustion air undergo strong swirling motion with high degree of turbulence and mixing resulting in a stable and high intensity combustion. A good combustion efficiency and high temperature is



Cyclone furnace developed at RRL, Bhubaneswar

By undertaking an in-house R&D programme, RRL, Bhubaneswar, has developed an experimental cyclone furnace of 100 kg/hr coal burning capacity. This furnace has been tested with coals of different ash content.

The main furnace characteristics like furnace temperature, efficiency, heat release rate, heat transfer through furnace wall, and slagging behaviour are established. The studies included the effects of important variables like: (i) air fuel ratio; (ii) air preheat temperature; (iii) size of coal feed and coal type; and (iv) ash content.

The experimental cyclone furnace has to a great extent been able to achieve the expected performance envisaged in its design.

As regards the future programme, attempts are being made to undertake the scale up design of an industrial scale cyclone furnace in collaboration with user industries. Potential users are welcome to participate in such a joint venture for wide application of this advanced technology. □

normally attained. A temperature greater than 1600°C is achieved by burning coal with near stoichiometric air-to-fuel ratio where most of the residual ash melts and is discharged as slag from the system.

A cyclone system has a number of advantages over the conventional pulverized coal (p.c.) firing systems. In p.c. firing the combustion process is usually slow because the fuel in the form of fine particles is entrained in Stoke's flow condition and the temperature in the furnace is mostly limited to 1200-1300°C. The cyclone furnace, which overcomes these shortcomings, ensures a much faster combustion. The ash-handling system is also very much simplified in this case with flyash carryover minimised. In general, a cyclone furnace is capable of providing operational flexibility with different types of coal with varying ash and moisture content.

Various types of cyclone furnaces have been developed in many foreign countries and mostly used in fired boilers and gas turbine systems. Even developmental work on

cyclone type furnaces are being done to use them as process heaters in industries. The cyclone furnaces developed abroad mostly burn coal having ash content ranging from 10 to 30% and ash silica ratio 55 to 65%. The furnace temperatures required in such cases are 1500 to 1700°C. The Indian non-coking coals, on the other hand, have 30-45% ash where the silica ratio is very high 75-83%. Slag tap firing of these coals obviously requires a much higher furnace temperature as well as special design considerations.

The Regional Research Laboratory, Bhubaneswar, has taken up R&D work with the objective of developing a cyclone combustion system to burn high ash and high volatile Indian coals because such a combustion system has varied applications in the country. Not only in coal fired boilers, cyclone furnaces can also be used in chemical and metallurgical industries, where at present oil firing systems are in operation. Cyclone combustion is also considered as a viable system for achieving the very high temperatures necessary in coal fired MHD power generation.

From steel mill slag to fertilizer

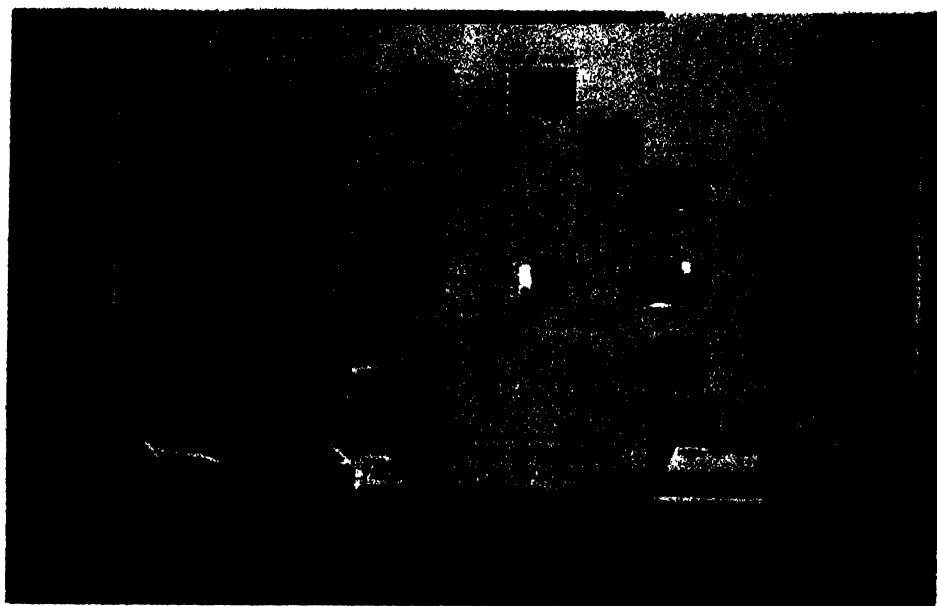
IN steel industry, many substances are generated as wastes. Till the 60s, hardly any attention was paid in steel industry to use these wastes. But growing awareness and stringent pollution gradually forced many industries to find suitable disposal methods for wastes. In the developed countries, over 80% of wastes are either used or recycled in the steel plant; Japan uses 90% and France nearly 100%. The production of Steel Mill (SM) slags in the world is around 80 million tons and is being produced at the rate of 100-200 kg/ton of liquid steel. It is estimated that nearly 5-10 million rupees worth of

materials can be produced from a one million ton steel plant in the country.

SAIL generates 1.7 and TISCO 0.4 million tons of the slag annually. RRL, Bhubaneswar, therefore began to study the flocking of SM slag in the presence of mineral additives. The project was funded by the TISCO, Jamshedpur. There are some obvious advantages of finding an economical method of grinding S M slags. It would liberate entrapped iron scrap for recovery and recirculation, and the powdered slag would be available for use as a fertilizer. As conventional methods of grinding are not cost effective, the present work envisaged automatic flaking of slag by using an appropriate operation with or without the use of additives. It has the broad aims of (a) liberating the untrapped iron and also recover all iron from the slag; (b) creating a reducing condition to liberate all iron in the form of nugget and then allowing self flaking of slag on cooling; and (c) incorporating phosphorous from rock phosphate to make it citrate soluble fertilizer during final cooling of slag. The problem was looked at from various angles of chemistry, extractive metallurgy, kinetics, chemical and thermal analysis, and the whole mass of data was integrated. A conceptual approach was suggested for possible application of the findings which were made available to the TISCO in the form of a report. □

Wealth from Waste — an exhibition

AN exhibition was organized jointly by CSIR Polytechnology Transfer Centre (CSIR-PTC), Lucknow, and Central Leather Research Institute (CLRI), Madras, in their Fallen Carcass Utilization Centre at Bakshi-Ka-Talab, Lucknow on



An exhibit from "Wealth from Waste" showing the various technologies involved in utilising fallen carcass

26th September 1994. An impressive visual show was made to highlight the achievements of CSIR-PTC, Lucknow, and CLRI, Madras, the major attraction being the simple, cost-effective, environment-friendly technology for fallen carcass utilisation. Details of the CLRI Technology were shown with the help of photographs and video shows under the heading "WEALTH FROM WASTE." A number of flayers and members of their societies from Lucknow, Sitapur and Barabanki visited the exhibition. Visitors were taken around the Centre to elucidate the merits of the technology. Short write-ups on the technology in Hindi, Urdu and English were distributed along with the literature on the activities of CSIR-PTC, Lucknow, and CLRI, Madras. A simple, clean unit for processing one to three carcasses per day can be established as a commercially viable and respectable proposition with an initial investment of five lakhs. □

Technology for fallen carcass utilization

AFTER agriculture, leather industry is the oldest profession being practiced at small scale mostly in rural India. About 78% of the raw material needed for leather industry is derived from fallen carcass. After taking off the hide, the carcass is generally left in open fields to be consumed by predatory birds and animals. In addition to creating serious pollution problems a number of valuable materials other than hides and bones are lost amounting to a loss of about Rs 1000 crores per year. Absence of an economically viable and environment-friendly technology to process fallen carcasses suited to the conditions prevailing in our rural areas is the reason for this malaise.

The Central Leather Research Institute, Madras, has developed effective, simple, low-cost technologies and equipment for complete utilization of carcasses. Based on these findings an R&D

project, sponsored by Deptt. of Biotechnology, Govt. of India, was taken up to establish an Ideal Carcass Recovery Centre at Bakshi-ka-Talab, Lucknow. Training and demonstration unit for processing 3-4 carcasses per day has been set up at Bakshi-ka-Talab, Lucknow, and a technology package is being offered by CLRI, Madras.

The Ideal Carcass Utilization Unit comprises Flaying Yard, Wet Rendering Vessel, Meat Mincer, Storage Space and Septic tank. The carcass is brought directly to the flaying yard and lifted with a chain pulley hoist. Horns, hoofs, tail, ruminal contents, etc., are separated. Flaying is carried out by using improved tools and techniques developed by CLRI, Madras. Washings collected in the septic tank are used for subsurface irrigation after anaerobic treatment. Ruminal and intestinal contents are converted into manure by composting. Hides are collected and stored for further processing while the flesh and bones are chopped into smaller pieces and fed into the wet rendering vessel. It is cooked for 5-7 hours by steam produced in the vessel itself. Wood or coal is used for heating the vessel. In this operation the separation of meat and bones takes place and tallow gets collected at the bottom of the vessel. Meat is then removed from the bones and fed into the mincer for further processing to prepare meat meal. Bones are collected and put under sand for drying. In this way every part of the carcass is utilised properly in a pollution-free manner. □

CFRI participates in EXPO '94

EXPO'94 was organised at Durgapur, West Bengal, by Durgapur Children's Academy of Culture to celebrate its first Annual Festival. The festival held from 8th to 28th



CFRI stall at EXPO'94 displaying its processes and inventions

December'94 had Trade and Industrial Fair besides Children Fair, Book Fair, Art handicrafts and Science Exhibitions and cultural programmes. The Industrial Fair was inaugurated on 8 December 94 by Dr Sankar Sen, Hon'ble Minister for Power, Govt. of West Bengal.

The stall of Central Fuel Research Institute, Dhanbad, displayed its processes/inventions on: (i) Fly ash brick; (ii) Mini coal flotation plant; (iii) Briquette fuel for domestic uses; and (iv) Improved domestic chullah with ignitors for efficient ignition. Besides CFRI displayed the MoU recently made with MECON on the processes related to coal chemicals developed at CFRI. A large number of entrepreneurs, Government officials and representatives from industries visited the CFRI stall and showed keen interest in the CFRI processes displayed there. □

Agreement with University of Sheffield

AN agreement between the University of Sheffield, U.K., and the Council of Scientific & Industrial Research (CSIR) was signed by Dr. S.K. Joshi, Secretary, DSIR and Director General, CSIR and Prof. Gareth Roberts, Vice-Chancellor, University of Sheffield, on 13 January 1995 in New Delhi. The areas identified for joint cooperation between CSIR and the University of Sheffield are: medical instrumentation, water management, plant-based herbal products, materials including ferrous metallurgy and natural fibres. The collaborative projects under this agreement will be implemented in the spirit of umbrella MoU signed between the Government of India and Government of United Kingdom on 16 April 1981, and the new Indo-UK Science Initiative to be established shortly with joint funding from both sides and to be managed through Indo-UK Joint Committee. □

Singapore delegation at NAL

A senior delegation of information technologists from Singapore, headed by Shri Vijay Mehta, Executive Director of Singapore's National Science & Technology Board (NSTB), visited National Aerospace Laboratories (NAL), Bangalore, on 15 December 1994. The delegation had discussions with NAL scientists and visited R&D facilities of the lab. Dr B.R. Somashekar welcomed the visitors ("I hope this visit is indicative of our growing bilateral ties"), Dr K. N. Raju, Director, NAL, made a detailed presentation on NAL and its ongoing R&D pursuits and Dr U. N. Sinha introduced Flosolver, NAL's parallel supercomputer.

Shri Mehta spoke about Singapore's plans in R&D. The 'D' in R&D continues to dominate the 'R', he said. He suggested that Singapore not only has its R&D plans and priorities worked out to the last detail but also has a professionally crafted "game plan" to achieve those objectives.

India possesses the two elements which Singapore sorely lacks: land space and skilled manpower. There is every reason to hope that meetings such as the one held at NAL would lead to a mutually profitable end game. □

TRAINING COURSES

Mineral Extraction Technique for Small-scale Mines

A five-day course on Economically Viable Mineral Extraction Technique for Small-scale Mines was recently organized by the Central Mining Research Institute (CMRI), Dhanbad, in collaboration with National Institute of Small Mines (NISM), Calcutta.

Inaugurating the course, Shri B.K. Sharan, former Director Gen-

eral, DGMS, stressed the need for a viable technology by which mineral can be extracted without removal of overburden to make small-scale mining more economic.

Prof. B.B.Dhar, Director, CMRI, in his welcome address pointed out that despite its several social, technoeconomic and environmental drawbacks, small-scale mining sector has large employment potential and is a major viable means to cater to the sharply increasing need of minerals in the country. Providing this sector with economically viable mineral extraction techniques will therefore be very fruitful, he added.

Professor A.K.Ghose, former Director, ISM, Dhanbad, and presently the UGC Professor at Bengal Engineering College, Howrah, in his presidential address said that the problems of both micro-mining and small-scale mining sectors are varied and site specific. Hence, development of economically viable mineral extraction technique for such mines is really a challenging task.

Speaking on the occasion, Shri S.K. Chakraborty, Hony. Secretary, NISM, Calcutta, said that the objective of his Institute is to guide,

support and help the small-scale mines in all possible ways.

Shri R.P. Singh, Scientist and Head, HRD Cell, CMRI proposed a vote of thanks.

The course was attended by participants not only from India but also from Nepal and Bhutan. □

Mine Ventilation, Pressure Balancing and Cryogenic Techniques for Control of Fire

THE Human Resource Development Cell of the Central Mining Research Institute (CMRI), Dhanbad, recently organized a five-day course on Recent Advancements in Mine Ventilation, Pressure Balancing and Cryogenic Techniques for Control of Fire, to appraise the practising mining engineers of the recent developments in this dynamic and vibrant field of mining.

Inaugurating the course, Prof. S.P. Banerjee, Director-in-charge, ISM, Dhanbad, said that ventilation is essential in underground mines and is linked with the method of mining. Though the Indian mines at present do not have much problem of methane and carbon dioxide, these mines are likely to face serious problems owing to dust, fume, heat and humidity in the near future. He complimented CMRI for its work on application of cryogenic technique for dealing with the fire in mines.

Prof. B.B. Dhar, Director, CMRI, in his welcome address said that good ventilation is essential for safe and economic operation of underground mines, and therefore CMRI has been attaching prime importance in dealing with the theoretical as well as practical aspects of ventilation problems since its very inception. The Institute has so far carried out ventilation surveys in more than 150 mines, resulting



Delegates and guests during the inauguration of course on Economically Viable Mineral Extraction Technique

in improvement in their ventilation standards. It has also conducted ventilation planning of more than 35 mines using digital simulation of ventilation system with the aid of computers.

Some notable achievements of CMRI in the field of ventilation and fire control are: development of multi-zonal ventilation system using large diameter boreholes, the technique of dynamic balancing of pressure, and products such as airseal, thermoseal, hydrogel, inert chemical and high expansion foam.

Shri B.C. Bhowmick, Scientist and Head, Ventilation Division, CMRI, introduced the course content to the participants and Shri R.P. Singh, Head, HRD Cell of CMRI, proposed a vote of thanks.

About 30 persons representing different mining companies and organizations attended the course. □

NRDC Republic Day (1995) Awards for Meritorious Inventions

TWO CSIR processes have won the 1995 Republic Day Award of the National Research Development Corporation (NRDC) under its Invention Promotion Programme. The processes are:

Cross-linked macroporous polymer matrix: Dr. R.A. Mashelkar, Director, National Chemical Laboratory, Pune, and a team of co-workers, Dr S. Ponrathnam, Dr C.R. Rajan, Dr S.R. Naik, Dr J.G. Shewale, Dr G.R. Ambedkar and Dr K.K. Krishnadas have been jointly awarded a sum of Rs 50,000 for developing a novel cross linked macroporous polymer matrix for immobilization of industrial enzymes. The process is useful for producing immobilized Penicillin G Acrylase using the polymer matrix and 6-amino penicillanic acid using the immobilized enzyme. With

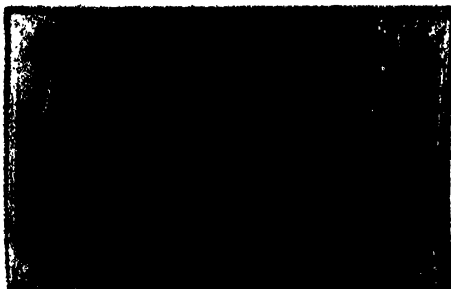
this invention, it is possible to produce 350 kg of 6-amino penicillanic acid per kg of immobilized Penicillin G Acrylase, as against 100 kg using the conventional cellulose-bound enzyme.

High set remote prop: Shri Sibnath Maity of the Central Mining Research Institute (CMRI), Dhanbad, has been awarded a sum of Rs 30,000 for developing a high set remote prop. It consists of a telescopic device having two cylindrical tubes for providing telescopic extension in the range of 600 mm-1200 mm. The prop, which can retain about 10 tonnes setting load, can be withdrawn remotely from a distance of 3-5 metres. It can successfully replace the presently used system which requires costly hydraulic equipment. □

Honours & Awards

Dr G.P. Phondke

Dr G.P. Phondke, Director, Publications & Information Directorate, New Delhi, has been awarded the



The gold plaque of the first B.C. Deb Memorial Award presented to Dr G.P. Phondke

first B.C. Deb Memorial Award for popularization of sciences for the year 1994-95. The award was conferred at the 82nd Indian Science

Congress held at Jadavpur from 3 to 8 January 1995. The award was instituted in the name of the late soil scientist B.C. Deb by his wife and it carries a gold plaque and Rs 5000 in cash. Dr Phondke also gave a popular talk on the occasion, 'Taking Science to the people', under the auspices of the Committee on Science and Society. □

IMM felicitates
Dr Mashelkar

THE Top Management Club (Pune Chapter) of the Institute of Marketing and Management presented a citation to Dr R.A. Mashelkar, Director of the National Chemical Laboratory, Pune, on 29 October 1994. The presentation was made at the hands of Padma Shri Homi J.H. Taleyarkhan.

Himself a Padma Shri, Dr Mashelkar received the presenta-

tion in appreciation of the immense contribution made by him as the leader of NCL, to the growth of S&T in the country. The citation records that Dr Mashelkar has been a resident of Pune since 1976 and that during his stay here he has contributed invaluable to the field of R&D in science and technology.

Dr Mashelkar took over as the Director of NCL in 1989. Under his leadership, this laboratory has grown into a global R&D platform interacting with leading multinational giants. He is internationally known for his work in polymer science and engineering. Shri Bahri B.R. Malhotra, President of the Pune Chapter of TMC, notes in the citation that Dr Mashelkar is an inspiration to every scientist and technocrat for his vision, innovation and ability for hard work. □

Printed and Published by Dr G.P. Phondke, Director, Publications & Information Directorate (PID), Dr K.S. Krishnan Marg, New Delhi - 110 012
Printed at PID Printing Unit

Editors: Dr B.C. Kashyap, Dilip M. Sahni and Madhu Sahni

Production: Kaushal Kishore

Annual Subscription: Rs. 60
Single Copy: Rs. 3.00

Phone: 5786301

Gram: PUBLIFORM

Telex: 031-77271

E-mail: pid@simetl.ernet.in

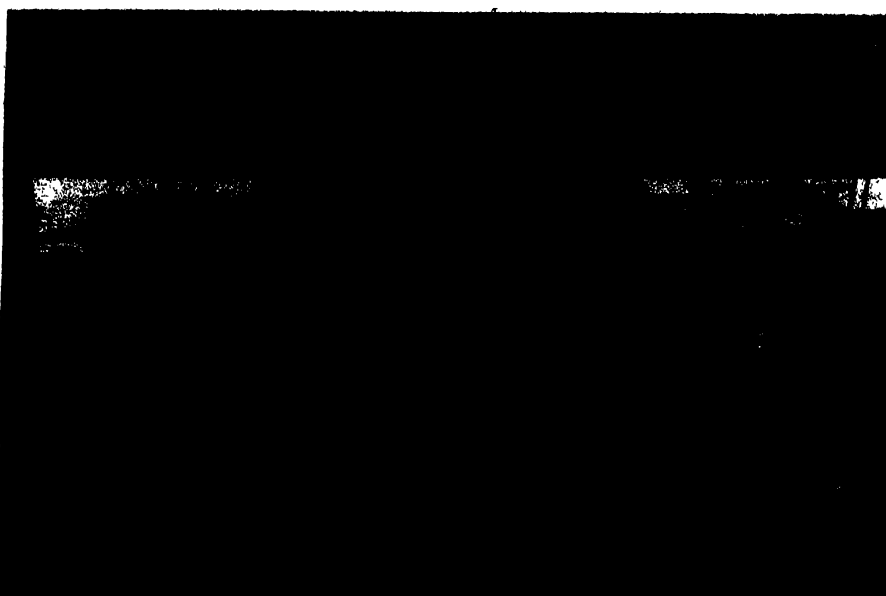
Fax: 5787062

RN 4512/57

CSIR



VOL 45 NO 4 28 FEBRUARY 1995



IN THIS ISSUE

India's first Mini-Flotation plant commissioned	50
National Metallurgical Laboratory, Jamshedpur: R & D Highlights: 1993-94	51
Traffic plan for Moradabad	59
Repairs and strengthening of quake-affected houses	62
Floriculture, floral craft and tissue culture	62
China porcelain for crockery manufacture	63

India's first Mini-Flotation plant commissioned: (Top) The plant under installation at Tetulia Coke plant. (Bottom) The first belt discharge type Vacuum Drum Filter installed in a coal washery

India's first Mini-Flotation Plant commissioned

A major breakthrough was achieved in coal beneficiation when the country's first ever Mini-Flotation Plant produced low ash coking coal from washery effluent and slurry at the premises of Tetulia Coke Plant, near Dhanbad. The Mini-Flotation Plant was set up by the firm under the total project consultancy offered by Central Fuel Research Institute (CFRI), Dhanbad. The plant was designed by CFRI and the erection and commissioning of the plant was done under its direct supervision. The low ash (13-15%) clean coal produced by the plant will be used as a blend along with other coals for making superior grade metallurgical coke for steel plants and foundries. The tailings or by-products containing about 45%-50% ash will be utilised to produce briquetted fuel for domestic use.

The process adopted in the plant involves a physico-chemical technique called "froth floatation". The fine coal particles (below 0.5 mm in size) are treated in a stirred tank using a reagent, called "collec-

tor". The treated coal slurry is fed into a series of flotation cells where air bubbles are generated by a specially designed diffuser - impeller system using a "frother". The coaly particles adhered to the air bubbles float on to the surface as froth. The ash-forming mineral matter remains in the pulp and is discharged from the cells as tailings. The froth containing low ash clean coal is dewatered in vacuum filter and separated as cake.

This 5 tph capacity Mini-Flotation Plant is also the first plant of low profile, i.e., of single floor with shed height 7.5 meter only. It will beneficiate coal fines below 0.5 mm size and the plant is capable to beneficiate difficult-to-wash low volatile medium coking coals. The capacity of the plant may be scaled up to a higher capacity on a customer's demand. All the equipment used in the plant are indigenously manufactured.

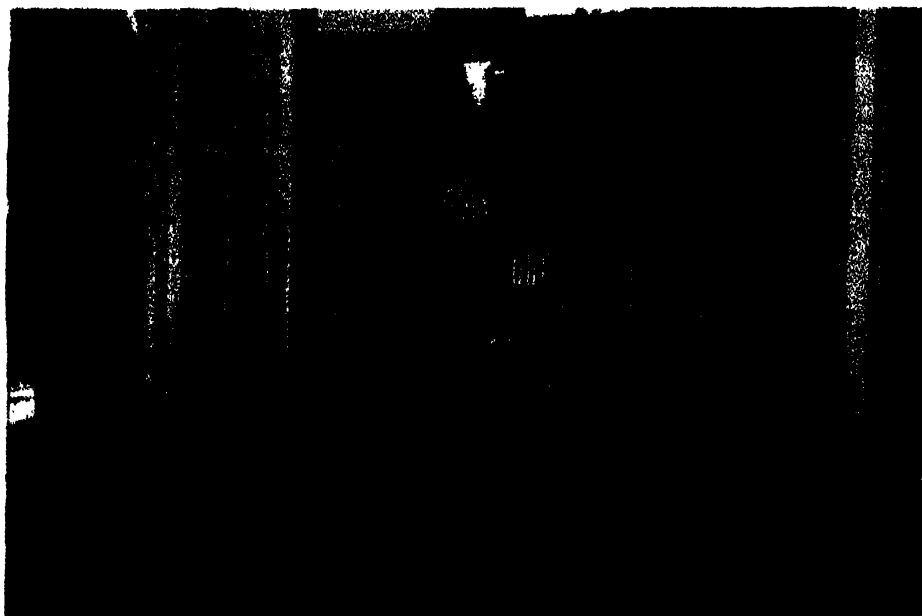
At present, all the coal washeries in the country face tremendous

problems to dispose of coal fines. These coal fines are mostly from good quality coking coals and therefore beneficiation of these coal fines regenerate good quality low ash coal which is a scarce commodity for steel plants and coke producers. Presently, about 7 million tons of low ash coking coals are imported every year. The technology developed at CFRI will therefore affect the economy of the country in the long run by saving valuable forex. It will also help produce good quality coke for industrial consumers at large and for foundries in particular.

The process adopted in the plant eliminates coal fines disposal problem in the coal washeries and reduces air pollution due to dust in the adjoining area. The liquid effluent from the vacuum filter is continuously fed back to the circuit. The water that accompanies tailings is drained into the settling pond and is clarified through permeable coke/sand beds and also fed back to the circuit. The whole plant therefore works on closed water circuit without causing any harmful pollution to the natural sources.

The plant produces two products, viz., : (i) low ash (13-15%) coal for making coke ; and (ii) tailings of 45 to 50% ash content. The latter is used for the production of briquette fuel for domestic uses and so cent per cent of the product has sale value!

The Mini-Flotation plant developed by CFTRI has received a good response from the market, particularly small and medium scale coke producers. Two more such plants are likely to be installed within this year. Many more coke producers are making enquiries for this technology. □



CFRI designed emulsifying tanks of the Mini-Flotation plant in operation

National Metallurgical Laboratory, Jamshedpur R&D Highlights: 1993-94

WITH the change in the economic scenario, conscious efforts have been made to reorient the laboratory to face the challenges of liberalisation and globalization. In the previous years, 3/4th of the extra budgetary "resources" of the laboratory used to accrue from 2-3 large projects. This has resulted in the laboratory being cut off from larger sector of the medium and small scale industries. In order to bring these into the fold and widen the clientele of the laboratory, several attempts were made including active dialogue with Confederation of Indian Industries (Bihar Chapter) and Bihar Industries Association. Several industrialists from these organizations have visited the laboratory and were apprised of its capabilities. A large number of informative, colourful and area specific brochures stressing NML's facilities and expertise were brought out and widely distributed at various technical get-togethers, exhibitions,

workshops and so on. As a result of these efforts, contributions from medium and small scale industries to the external cash flow of the laboratory have gone up considerably.

In order to freeze the contact with the industry and to build confidence in them, the concept of retainership has been introduced; four MoUs with the user industries have been signed. Under the retainership programme, a company pays an annual fee against which technical service is provided to solve their day-to-day problems. This is in addition to the already strong linkages existing between the Tata Iron & Steel Co. Ltd. and NML. Considerable efforts have also been made to project the capabilities of the laboratory at various exhibitions and marketing get-togethers. One activity requiring particular attention has been dissemination of latest technical

information to the industry through the conduct of workshops. Two of such workshops have been conducted during this period. These have proved to be highly successful and led to many more requests coming from the industries. These close interactions with industry on one-to-one basis have also sharpened the outlook of the NML scientists and made them aware of the needs of the industry. The economic benefits produced by NML, as estimated, amounted to: Savings produced - Rs. 21 crores per annum; Losses avoided - Rs 92 crores per annum; besides considerable value addition to the industrial production through NML's knowhow.

During this period, NML made considerable progress in its three Thrust Area Projects, namely: (1) Processing of polymetallic sea nodules for the recovery of valuable metals; (2) Beneficiation and purification of tungsten ores of India; and (3) Component Integrity Evaluation Programme (CIEP). All these projects are of national importance.

The project on beneficiation of tungsten ores from Rajasthan to enhance WO_3 content from 0.2-0.03% to 70% is successfully completed. This has led to the development of a flow-sheet, which combines both physical and chemical beneficiation routes.

Under the sea nodules project, large scale (100 kg/day) trials are being conducted to scale up operations for the recovery of copper, nickel and cobalt from the bench scale trials of Phase-I. So far this programme received funding to the tune of Rs 4 crores from the Department of Ocean Development. Results obtained to date are en-

International collaboration projects at NML

TWO Indo-US projects were executed in the laboratory : (1) Advanced high strength ferrous alloys and (2) Mechanical properties of advanced ceramics. The first project was undertaken with an objective to develop high strength, high weldability, low carbon ferrous alloys with good toughness and low ductile, brittle, transition temperature. A number of low carbon (less than 0.03) alloys were made and given thermo-mechanical treatment. Presence of desirable acicular ferritic structure with high dislocation density was established through Transmission Electron Microscopy (TEM). Extensive dilatometric studies were undertaken

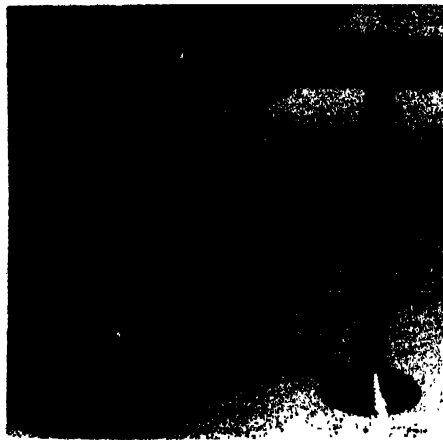
to establish the CCT characteristics of the material. Percentage of deformation in rolling and finish rolling temperature were optimised to produce the required microstructure. The effect of simulated variables of tensile temperature/time/rapid cooling on the microstructures of these steels has also been studied using gelable instrument. In the second project, FCCR data on 25 wt% SiC reinforced alumina ceramic has been generated for the first time in India. This was possible with an articulated bridge fixture fabricated at NML. The bridge was used for precracking, whereas the FCCR tests were carried out on four point bend fixture. □

couraging and the group is pursuing the programme energetically.

Under the CIEP programme, 14 generic and five sponsored specific projects have been under progress, generating the necessary background and methodology for the prediction of life of and failure in industrial components. A large database has been created and several user friendly softwares have been developed for the use of the sponsors. It is a good example of close interaction between NML and industry with a total financial support of about Rs 2.5 crores from the TISCO, SAIL, IOC, BPCL, DAE and an additional soft loan of about Rs 3.5 crores from the World Bank.

In the area of mineral processing, besides routine assignments undertaken, a synergic approach towards conservation of mineral resources of the country is followed. The activities include evaluation and on site advice on mineral resources, waste utilization, pollution abatement, feasibility reports, trouble shooting and upgradation of working plants, assistance in plant design and commissioning. Societal benefits that are financially intangible include conservation of mineral wealth, Indian alternative resource for a strategic metal like tungsten, utilization of high ash coals, and averting pollutants through utilization of fines of various ores.

In the areas of material processing, characterization and evaluation, besides routine activities, many national and international assignments were completed. The results of these projects are at various stages of commercial evaluation and scale up. To quote a few major ones; sticker problem in hot rolling; superplasticity in ultra high carbon steels; Indo-US programme on ultra-low carbon high strength steels for offshore applications; mechanical properties of advanced ceramics; improvements in



Exhaust valves made of Nickel-free steel

mechanical and magnetic properties in commercial HSLA steels; high purity iron powder (electrolytic) and components therefrom; and SiC whiskers.

Four different grades of creep resistant steels produced in the country underwent extensive creep evaluation. As a result the production of these steels has been indigenous and also existing creep database got further extended. Life extension studies on several critical components at Renusagar Power Plant and also that of FCCU-I Reactor of HPCL were carried out. Knowhow for NML's Ni-free steels for exhaust valve application was transferred to M/s. Star Wire (India) Ltd., New Delhi, and a few commercial heats produced and rolled into desired shapes. The exhaust valves operates at a temperature of 700°C.

Significant achievements in the area of ferrous processing include know-how/technology for production of 75% ferro-silicon by using barely 10% charcoal and rest non-coking coal and coke; production of industry floor and decorative tiles utilizing steel plant wastes; increasing oxidation resistance of carbon/graphite by high temperature heat treatment; development of torpedo ladle car mixes and industrial utilization of CIL coke from Dankuni Coal Complex of Coal India Ltd.

In the area of non-ferrous processing, besides the DOD project on sea nodules, many other sponsored and collaborative projects were under pursuit. Mention may be made of a few: electrolytic manganese dioxide from manganese ore for M/s MOIL, Nagpur; smelting studies on nickel chromium cobalt bearing magnetite from Nagaland; and recovery of gold and silver from the dross.

In the area of corrosion protection, several collaborative and sponsored projects were carried out. Technologies developed relate to cathodic protection of pipe lines, corrosion of metals under marine environment, improved flux for galvanizing plants, quality improvement of tin plated sheets. Further, work in the area such as corrosion fatigue, stress corrosion cracking and hydrogen embrittlement are under progress.

The technologies ready for exploitation are: (1) electrolytic iron powder from sponge iron fines, (2) production of ceramic tiles and decorative blocks from iron ore slimes, fly ash, etc., (3) chemical MnO₂ and activated MnO₂, (4) Galvasave, and (5) ceramic crucibles for C&S determination in metals.

During 1993-94 four processes, i.e., (1) Production of copper power; (2) Production of Ni-free valve; (3) Fly ash based wear resistant ceramic products; and (4) Calorising of steel, were released to four different parties.

NML's efforts in mobilization of extra budgetary resources (EBR) from the users yielded Rs 189.21 lakhs during 1993-94 and a major portion of the fund is utilized for procurement of modern equipment and facilities for the laboratory. Public sector including Government departments contributed 80% of the EBR while the Private sectors' share was 20%.

Sponsored research at NML

Development of SiC whiskers:

The project aims at development of a process to produce β -SiC whiskers from rice husk. β -SiC whiskers are required for metal matrix and ceramic matrix composites. The process has been developed and patented (jointly with CSIR and AR & DB) to produce 80-90% β -SiC whiskers in the final product using a low cost additive instead of costly catalysts like Ni, Pd, Pt, etc. Negotiations are in progress for a funding agency for the scaling up of the above process from 20 gm/batch to 2 kg/batch.

Evaluation of flowsheet for the phosphate soil:

A low grade phosphate soil from Uganda was obtained through Rajasthan State Mines & Minerals Ltd., Udaipur, Rajasthan, for: (i) carrying out confirmatory studies on the flowsheet developed by Bearden-Potter Corporation, USA, and (ii) to give an order of magnitude of cost projection for processing. A super concentrate analysing over 40% P_2O_5 could be achieved at the laboratory studies. Further, studies are in progress for improvement and streamlining of process flowsheet.

Briquetting and pelletisation of phosphate concentrate:

Briquetting and pelletisation studies were undertaken on phosphate concentrate sample from Rajasthan State Mines and Minerals Ltd. for the manufacture of elemental phosphorous. It was found that 1% molasses, 7% bentonite with 10% water resulted in yield of 90% in briquetting roll. The crushing strength was 2.5 kg/ briquette when green 4.12 kg/briquette after 25 hours and 9.9 kg/briquette after 48 hours. The briquette showed good thermal resistance at 1400°C. The pelletisation studies were also carried out using different binders, giving 19 drops and 0.8 kg crushing strength when green and more

than 40 drops and 20 kg crushing strength after drying.

Coal beneficiation and slurry combustion:

The project on coal beneficiation and slurry combustion for non-coking coal was taken up with CFRI, Dhanbad, as nodal agency and RRL, Bhubaneswar, and RRL, Bhopal, as other participating laboratories. Accordingly a series of meetings was held to formulate the work plan and distribution of work load. Scientists from NML along with CFRI and RRL (Bhubaneswar) visited Talcher Thermal Power Station (TTPS) and worked out a sampling device to collect sample from feeder coal conveyor over a prolonged period to yield a representative sample. The samples were sent to different laboratories by TTPS. Large scale jigging was performed at RRL-Bhubaneswar by a team comprising scientists from participating laboratories. Jigged clean coal of 25% ash (approx.) was taken to individual laboratories for further studies. Detailed investigations were carried out adopting different

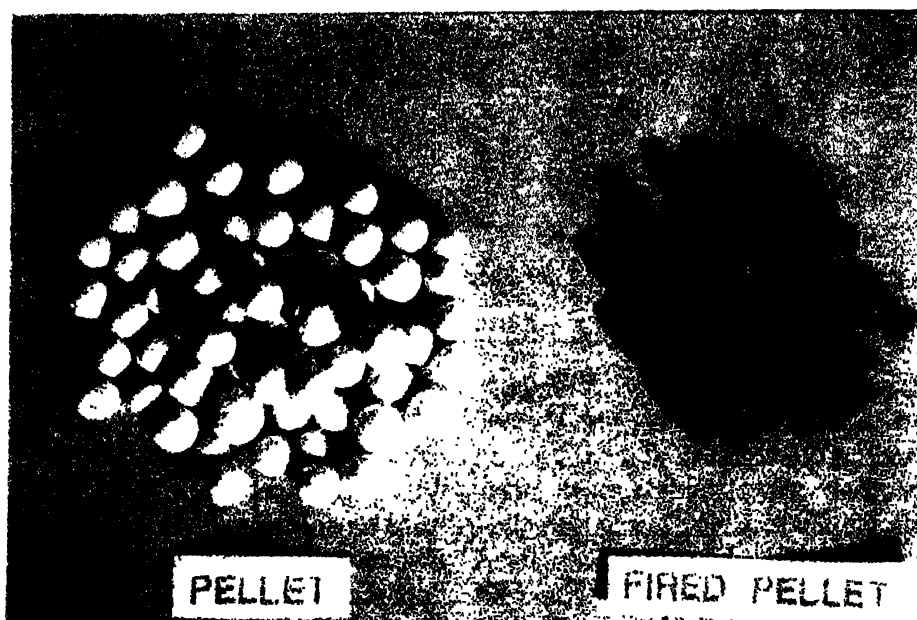
beneficiating schemes. Results obtained were encouraging and discussed in subsequent meetings.

Assessment of magnesite resources:

At the instance of Tata Refractories Ltd., an assessment of magnesite resources in Karnataka was carried out. After detailed studies carried out on the reject dump, process route for producing a concentrate analysing 2.02% silica with an yield of 58.8% could be obtained. It was also established on the basis of vein sample that a product assaying 2% silica and 37% yield was possible. Pellets were made using the concentrate obtained in the studies with 2% SiO_2 and fired at 1750°C. The fired pellets showed acceptable refractory properties. The studies established a process for the effective utilisation of waste and sub-grade dump samples of magnesite lying unutilised.

Mathematical modelling in ferro-silicon refining process:

Low aluminium ferro-silicon has a very significant impact in the production of various kinds of silicon alloy steels of electrical grade.



Green and fired pellets - concentrates of magnesite ore from Talur, Karnataka

Facilities at NML



Non-destructive testing facility



Setup for conducting leaching studies

nomenological aspects of the process. The activity is a part of the SAIL sponsored project.

Beneficiation of lead and zinc concentrates: Feasibility studies were carried out on the rougher concentrates of lead and zinc from Rampura Agucha Mines of M/s HZL, Udaipur, to establish their amenability to beneficiation (cleaning) in flotation column. Studies were carried out using NML designed 3" diameter column both at Rampura-Agucha lead/zinc ores. Characterised by their complex mineralogy consisting of sulphides and oxides, graphite pose problems in flotation circuit. Galena and sphalerite are interlocked and also with quartz pyrrhotite and graphite. The non-sulphidic lead-zinc values also contribute to the poor flotation of lead.

The operations (3000 TPD) at Rampura Agucha Mines involve conventional froth flotation of lead first, viz., roughing, followed by 3-stage cleaning and scavenging. The tailings of the lead circuit is fed to zinc flotation consisting of roughing, 4-stage cleaning and scavenging. M/s HZL is faced with the problems of low grades/recoveries of both lead and zinc in their conventional flotation circuit and has sponsored a project to establish the feasibility of column cells in place of conventional cells in their lead/zinc cleaner circuits to NML, Madras Unit.

In the case of lead, two stage column cleaning was found essential to obtain high grade concentrates assaying about 70% lead containing minimum pyrite and graphite with lead recoveries in the cleaning circuit ranging from 90-95%. Zinc concentrates obtained from single stage column cleaning were found to be better compared to the existing practice of 4-stage cleaning by conventional circuit. Depending on the feed grade to column, final zinc concentrates as-

Chemical kinetics and transport phenomena play a very crucial role during the refining of ferro silicon. Mathematical models have been developed to simulate the rate phenomena of the low aluminium ferro silicon refining process. The rate constants, order of reaction and kinetic parameters have been pre-

dicted by kinetic model. The transport process model simulates the bubble growth dynamics during refining process as a heat/mass transfer controlled phenomena on the basis of an integral control volume based numerical approach. The mathematical modelling gave a deeper understanding of the phe-

Thrust area projects at NML

Beneficiation and purification of low grade tungsten ore : Tungsten metal is of strategic importance to India. But the available tungsten ore reserves are of lean grade, assaying 0.03 - 0.2% WO_3 . Presently, majority of the country's requirement is met by import. Considering the need a Thrust Area Project (TAP) was undertaken at NML on the sponsorship of Defence Metallurgical Research Laboratory (DMRL), Hyderabad, to develop the process flow-sheet for the beneficiation of indigenously available lean grade tungsten ore deposits.

The project was started in 1988. A novel approach combining physical and chemical beneficiation routes have shown the possibility of upgrading the ores to the specifications laid down by DMRL. Based upon the extensive studies carried out on various ore samples, namely, off-grade concentrate, waste dump sample and trench lode granite samples, process flow-sheets have been developed.

During the final phase of this Thrust Area Project on tungsten, exhaustive studies were carried out on Granite III sample, assaying 0.138% WO_3 . A combination of magnetic flotation and gravity separation of -10^{-3} microns size, has resulted in concentrate assaying 27.9% WO_3 with 62.5% recovery. Hindustan Zinc Ltd. is the user of this technology.

Processing of polymetallic sea nodules for the recovery of valuable metals : Copper (Cu), Nickel (Ni) and Cobalt (Co) are the strategic metals for making different base metal alloys and steels

which are imported annually valued at nearly Rs 1500 crores in India. Due to limited land based resources, it is extremely difficult to cope up with the future demand of these metals. Recent exploration and survey studies in the Indian Ocean have proved that the central Indian Ocean basin have potential reserves of these metals. The National Metallurgical Laboratory has developed a process which consists of Reduction-Roast, Ammoniacal Leaching, Solvent Extraction and Electrowinning (RR-AL-SX-EW) to recover copper, nickel and cobalt. The project is funded by the Department of Ocean Development (DOD) and will decide on the choice of technology for scale up from 100 kg of nodules per day to a level of 2 tonnes/day, also subsequently the semi-commercial demonstration plant to extract Cu, Ni, Co and Mn from the sea nodules. Based on the bench-scale data (1 kg. batch), the process was scaled up to a level of 100 kg nodules per day. The overall recovery of copper and nickel metals were 85% each and that of cobalt was 50%.

Component Integrity Evaluation Programme : The Component Integrity Evaluation Programme (CIEP) has been launched in 1991 to cater to the growing needs of the industry. While the initial focus has been on the major sectors of the industry like power, petrochemical, steel, etc., the needs of the middle and small sector industries are also being taken care of now. This is an interdisciplinary programme where the expertise is drawn from various divisions of NML.

CIEP has envisaged time bound projects related to impor-

tant industrial problems like component life assessment, extension and prediction. This involves comprehensive mechanical testing and microstructural investigations in the laboratory to create a database that would be needed to evolve appropriate methodologies and thus be able to evolve appropriate component life. Associated with the laboratory investigations, two other important aspects are : (a) development of softwares for data analysis and predictions; and (b) development of non-destructive test techniques for in-situ assessment of damage in components before and after crack initiation.

Test facility has also been significantly augmented through procurement and installation of several sophisticated equipment. The units which have already started operating are : a Multi channel Acoustic Emission System for in-situ examination of pressure vessel, a Portable X-ray Residual Stress Measurement System, an Electromagnetic Resonance Fatigue Testing Machine (10 MT), a Blind Hole Drilling System for residual stress measurement. A spherical pressure vessel is being fabricated for subsequent use along with the Acoustic Emission System to evolve procedures for testing and locating critical defects in similar components at site. The portable residual stress analyser was also carried to the site for measuring residual stresses developed in critical locations of a rolling mill drive which was being weld and repaired at Tata Steel. In-situ metallography and non-destructive testing work was also undertaken at several boilers and turbo generators.



Atomized metal powder

saying 47-57% with minimum acid insolubles of 3.0 % could be easily achieved with a recovery of more than 90% zinc by adopting single column in place of existing four stage cleaning in conventional cells.

In general, the performance of column as cleaner cell was found to be superior compared to conventional flotation cells. There is considerable metallurgical benefit to M/s HZL by implementation of column in their cleaner circuit by way of substantial savings in power, operating costs, etc. The implementation of column flotation technology is expected to benefit M/s HZL to the tune of nearly Rs 25 million for its two concentrators.

Beneficiation of pyrophyllite: Pyrophyllite, $\text{Al}_2\text{O}_3 \cdot 4\text{SiO}_2 \cdot \text{H}_2\text{O}$ is an important raw material for the refractory (insulation), ceramic and insecticide industries. It is also used as a filler in rubber and allied industries. Eastern Minerals Ltd., Jhansi, is faced with a problem of contamination of pyrophyllite with gangue minerals like quartz, silicates, etc. At the instance of the

party, NML conducted extensive studies on the beneficiation of pyrophyllite sample containing 78.97% SiO_2 , 17.12% Al_2O_3 and 1.16% Fe_2O_3 .

High intensity magnetic separation of -3mm crushed sample at 20000 Gauss yielded non-magnetic fraction assaying 0.34% Fe_2O_3 . This fraction ground to 90% - 200 mesh was floated with both anionic and cationic collectors. Cationic flotation was more efficient and a pyrophyllite concentrate could be obtained.

The implementation of the technology as suggested by NML is expected to benefit the party to the extent of Rs 1.5 million for a 100 tpd plant.

Characterization of low grade tungsten and gold ores: NML is carrying out characterization studies on various gold ore samples from Purulia region, West Bengal, sponsored by Directorate of Mines and Minerals, W. Bengal. After prospecting, it is proposed to take up beneficiation studies on the suitable bulk sample. Work has been taken up on characterization

of various tungsten ore samples from Bankura region. Bench scale beneficiation studies on granite ore and mine reject samples involving gravity magnetic and flotation methods are in progress.

Characterization of overburden rocks: The objective of this study was to obtain necessary data to design and install a facility for crushing the Kathara overburden rocks to 150 mm top size at the mine site. The crushed rock will facilitate easier caring and spreading at the dumping site, 4-5 km away from the mine by a conveyor system. A series of characterising studies was carried out on the two (grey and black) received rock samples. Both the rock samples exhibited typical composition of sand stone — the black variety contained large grain size and was more compact in texture. The maximum crushing strength of the black rock sample was higher than that of the grey sample, while the Bon's work index of the latter was higher than the former.

The production of 75% ferro-silicon: NML has carried out the smelting trials of ferro-silicon production (70-75% silicon content) on sponsored basis in its pilot scale 500 KVA submerged arc furnace for Bhutan Ferro Alloys Ltd., Phuntsholing of Bhutan. A number of compositions of charge mix were tried, decreasing the percentage of charcoal in the mixed reductants upto about 5% and process parameters were optimized. The results of these investigations will be the basis for further smelting trials in the upcoming industrial plant of Bhutan Ferro Alloys, Bhutan.

Industrial utilization of coke and coke fines: The project is aimed at exploring the possibility for the industrial utilization of Coal India Ltd (CIL) coke and coke fines produced at Dankuni Coal Complex. Studies were carried out to make use of CIL coke for Ferro alloy

Collaborative projects at NML

IN collaboration with Tata Steel, the laboratory conducted several projects. One is the development of extra deep drawing steels with higher R value. The process parameters during hot and cold rolling were varied. The rolled and annealed sheets were characterised on the basis of microstructure, texture (by XRD) and properties such as R, n, Erichson value, UTS, YS, % Elong. The structure - property correlation was made and the process parameters were optimised to give the best R values.

The project for improvement in flux used for economical galvanising is also pursued in collaboration with Tata Steel. Some fluxes based on triple salts have been synthesized and some are now under evaluation for their fluxing properties.

NML-galvasave, a passivator to control the white rusting on galvanised tubes and sheets, has been under evaluation for a year. The tubes treated with this passivator has been exported to different countries and no adverse report was received from any country. Now the passivator is in regular use at Tube Division of Tata Steel. Completion report was submitted to Tata Steel.

Eight types of steels supplied by Tata Steel were exposed at both Industrial (Jamshedpur) and Marine (Digha) atmosphere for 3, 6, 9 and 12 months for observing their corrosion behaviour. Rust (corrosion products) collected was analysed by XRD. Salt spray test and electrochemical studies were also conducted.

Meteorological data, SO₂, NaCl, pH rainfall were also collected for a year. Data were compiled and analysed. Completion report was submitted to Tata Steel.

Preparation of nano-sized alumina was proposed to Tata Steel. It was approved by Apex Committee of Tata Steel. The total cost of the project is Rs 15 lakhs. Tata Steel has released Rs 6 lakhs for the project. Aluminium alkoxide was prepared by the reaction of aluminium and alcohol. This alkoxide was used to prepare sol-gel. The gel was dried and calcined to prepare Al₂O₃. XRD, SEM and TEM studies on Al₂O₃ were conducted. The process has now been scaled up to 2 kg/week.

In collaboration with SAIL, the laboratory conducted research on increasing oxidation resistance of carbon/graphite products by high temperature heat treatment of carbon/amorphous graphite in the temperature range of 2000-2400°C. Subsequent oxidation studies with heat treatment carbon samples and magnesite indicated improvement in reactivity in the range of 30- 40%. The ash percentage in graphite gets significantly reduced during heating. This opens up a new possibility of using high ash carbon samples for refractory making. XRD analysis of the heat treatment samples showed a remarkable improvement in degree of graphitization.

With the IOC, the laboratory conducted a project to establish definite guidelines for reliably predicting life of process heater

tubes during service in refineries. These are made of Cr-Mo steels and are subjected to high temperature and high pressure in presence of corrosive environments. These conditions induce microstructural changes which would adversely affect the performance and the remaining life of these tubes. In order to characterize and subsequently evolve an appropriate guideline for their replacement, post exposure tests for microstructural characterisation, mechanical property evaluation and magnetic property measurement were conducted on a number of tubes from various IOC refineries exposed to 80,000 - 2,20,000 hours of service. The test data indicate that although there is a significant change in the microstructure as a result of service exposure, the loss of YS, UTS or rupture strength is marginal. The major form of deterioration has been identified to be the loss of rupture ductility and fracture toughness. This is primarily due to carburisation of the inner wall of the tube. Based on the magnetic property evaluation, a non-destructive method for determining the depth of carburization has also been suggested. A remaining life estimation framework in the form of a user friendly menu driven software package RELIFE-H has been developed based on rupture and fracture toughness. The package facilitates to create and update test data and plant operating data and provides a definite guideline to estimate remaining life for the timely replacement of tubes. □

and DRI production. Agglomeration studies of coke fines for use in industrial furnace were successfully carried out. This will enable CIL to sell its coke and coke fines, as a value added product for metallurgical and industrial use.

Feasibility studies of column flotation: The project is sponsored by Gujarat Mineral Development Corpn Ltd (GMDC) with a view to improve their present beneficiation operations on multimetal sulphides at Ambaji. Column flotation has been suggested by NML for their cleaner circuit. Accordingly, a research programme is in progress at Ambaji to produce bulk copper lead-zinc concentrate containing more than 50% total metal content with recoveries above 80%. NML has installed its 3" diameter column cell and the results obtained so far were encouraging.

Beneficiation of fluorspar by column flotation: The sponsor M/s GMDC has been faced with the problem of achieving good quality acid grade fluorspar concentrate with low P_2O_5 content at their Kadipani operations (500 tpd). The P_2O_5 content in the final concentrate is high and varies from 0.15% to 0.6% depending on the phosphate content in ROM. Further, M/s GMDC's operations are not economically viable due to sharp decline in the prices of CaF_2 concentrate.

NML investigated the feasibility of column flotation to reduce the cost of production simultaneously improving the quality of the concentrate. The studies were aimed at reducing the number of cleaning stages (presently six) by adopting column cells for cleaning and recleaning. These studies were carried out with NML designed column cell (3" diameter) at the Kadipani plant on instream materials and the results were highly encouraging with good reproducibility. It also includes the metallurgical re-

sults (grade and recovery of fluorspar concentrate).

By incorporating column cells in their existing flow sheet, it is expected that M/s GMDC's operations will be globally competitive in terms of quality and the cost of production can totally replace the existing eight stages (four in ACID-SPAR circuit and four in METSPAR circuit) of conventional flotation. The adoption of column technology is estimated to benefit M/s GMDC to the tune of Rs 10 millions.

Smelting studies on Ni-Cr-Co bearing magnetite: The north-eastern region of the country is bestowed with vast natural resources. Most of these resources are untapped except for the exploitation of coal, oil and gas. The reported occurrence of magnetite deposit at Pokphur in Tuensang district of Nagaland is a matter of great interest and importance due to presence of chromium, nickel and cobalt. Exploration and subsequent utilisation of this ore body stands as potential contributor to the overall development of this economically backward region and warrants stagewise detailed investigation.

The characterisation studies on samples from this region has been done by the Regional Research Laboratory, Jorhat. Studies to explore the possibility of extracting metals from this deposit were undertaken at the National Metallurgical Laboratory, Jamshedpur, on the request of Directorate of Geology & Mining, Govt. of Nagaland, Dimapur.

Preliminary smelting studies were carried out in electric furnace on 25 kg. batch scale. It was possible to extract over 90% of iron, chromium, nickel and cobalt present in the ore in the form of pig alloy. The pig alloy obtained is suitable for the manufacture of alloy cast iron, Ni-hard and other wear

and abrasion resistant alloys. By adjusting the amount of reductant or by oxygen blowing of the pig alloy produced, it was possible to produce a low carbon pig alloy suitable for the manufacture of alloy/special steel. Recently the sponsors have agreed for pilot scale testing on 4-5 tonne pig metal/day scale in the existing 500 kVA submerged arc furnace at NML to establish the techno-economic feasibility of the smelting route and to produce sufficient quantity of the pig metal and get it evaluated by the user industries.

Development of low aluminium ferro-silicon: Low aluminium ferro silicon finds special application in the production of transformer sheets and special electrical steels containing silicon. A process has been developed to reduce the aluminium content in Fe-Si (75%) from 1.4% to 0.1% using carbon dioxide oxygen injection and chlorine donor methods. The experimental parameters were optimized and further scale up trials would be carbon dioxide injection method. The project was sponsored by RDCIS, SAIL, Ranchi.

Besides, in-situ metallography and hardness testing of boiler components were carried out for Renusagar Power Plant, Renusagar. The pre-exploratory work was undertaken to develop industrial floor (unglazed) and domestic wall and floor tiles (glazed) from waste materials such as iron ore slime, fly ash and blast furnace slag. The work was encouraged and has been sponsored by Tata Steel. Assessment of performance characteristics of the iron ores, limestone, quartzite, dolomite in terms of physical strength, chemical analysis, reduction degradation indices and reducibility was carried out from technical points of view for Nagpur Alloy Casting Ltd, Nagpur. The non-destructive testing procedure for estimating the remaining

life of critical components of turbo generator set for IOC was also established. Further work is under progress. Seven heats (20 kg each) of nitrogen and non-nitrogen bearing stainless steel were made utilising the NML's expertise and facilities and the raw materials supplied by the VSSC, Trivandrum. Further work is in progress. Melting, casting, shaping and heat treatments were carried out for the development of Invar alloy (36 Ni-64Fe) from scrap as referred by

SAC-ISRO, Ahmedabad. Coefficient of thermal linear expansion (α) was evaluated. Test results as well as test samples were sent to the party for further evaluation at their end. 40 kg scrap of coinage alloy received from Alipore Mint, Calcutta, were melted, casted and shaped to 1.5 mm thick sheet and are ready to be sent to mint for processing to coins. This will help Alipore Mint, Calcutta, to reuse the scrap generated in their Mint. □

Traffic plan for Moradabad

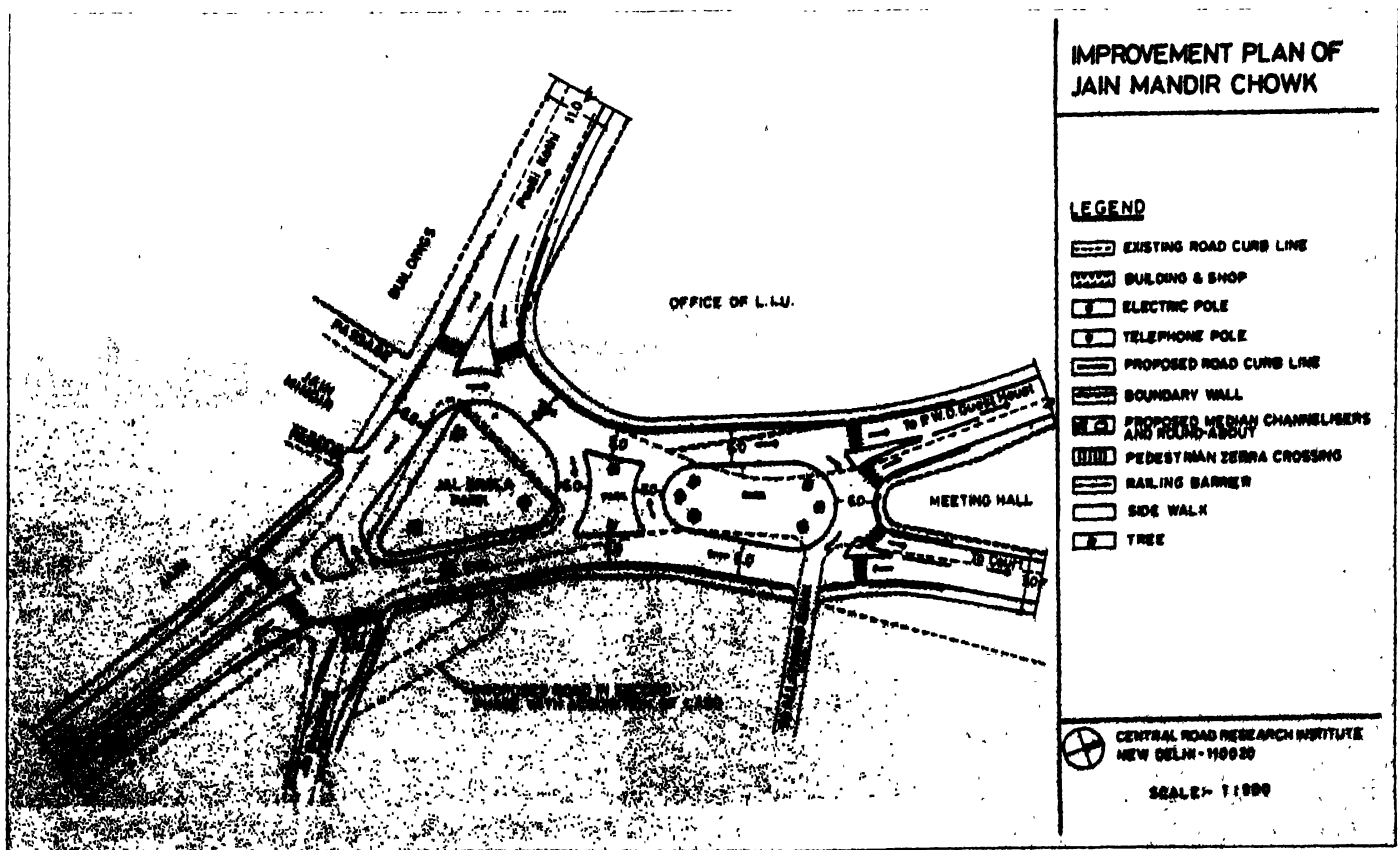
THE Moradabad Development Authority, Moradabad, had some time back assigned to the Central Road Research Institute (CRRI), New Delhi, the task of preparing Traffic and Transportation Plan for Moradabad [CSIR News 44(1994), 132]. For preparing the plan, CRRI conducted traffic studies and

evolved the traffic management measures comprising intersection designs, parking arrangements, traffic regulations, medians and channelizers, etc., to facilitate the traffic flow and improve safety and environment in the city.

The study conducted by the institute has shown that slow

moving vehicles like cycles, rickshaws and animal drawn vehicles constitute more than 65% of the total traffic on city roads and 50% on National Highway-24 near Railway Station and State Highway-49 near Police Training College. The average travel speed attainable on almost all the city roads and National Highway 24 ranges between 10-20 km. This low travel speeds are attributable to frequent traffic jams due to inadequate width of roads, location of petrol pumps at intersections, etc. The study also shows that traffic consisting of scooter/motor cycle/mopeds, buses and trucks is growing at 18-19 per annum on N.H. 24 and S.H. 49. The increase in the number of cars and jeeps has been found to be about 3% per annum.

CRRI has submitted Volume-I of the *Traffic Management Plan for Moradabad* to Moradabad Development Authority. The report deals



with the short - term improvement proposals for intersections and the stretch of N.H. 24 passing through the city. The proposals to effect smooth and safe flow of traffic are designed with due consideration to cost and least acquisition of land. Figure shows the recommended design of traffic intersection near Jain Temple. The improvement proposals for intersections near Mazhola, Government Inter College, and Jain Temple are being implemented. Work on geometric improvements and widening of N.H. 24 section passing through the city is in progress.

The second phase of the project pertaining to the preparation of road development plan for 2001 is in progress. □

New trends in Electrochemical sciences

A national seminar on 'New Trends in Electrochemical Science' was organized by the Karaikudi Chapter of Society for Advancement of Science and Technology (SAEST) on 23 December 1994 in collaboration with the Alagappa University, Karaikudi. It covered various disciplines of electrochemistry, including solar cells, conducting polymers and pollution control. Around 200 participants from all over the country participated in the seminar. Invited lectures on emerging areas were presented by eminent scholars in their respective fields. Nearly 70 research papers were presented in five technical sessions.

The seminar was inaugurated by Prof. G.V. Subba Rao, Director, CECRI, and presided over by Prof. P. Ramaswamy, Vice Chancellor, Alagappa University, Karaikudi. Dr K.C. Narasimham, Scientist, CECRI, released the souvenir, and Dr G. Prabhakara Rao, Deputy Direc-

tor, CECRI, and Dr T. Vasudevan, Reader, Alagappa University, graced the occasion. □

CECRI - Industry Meet

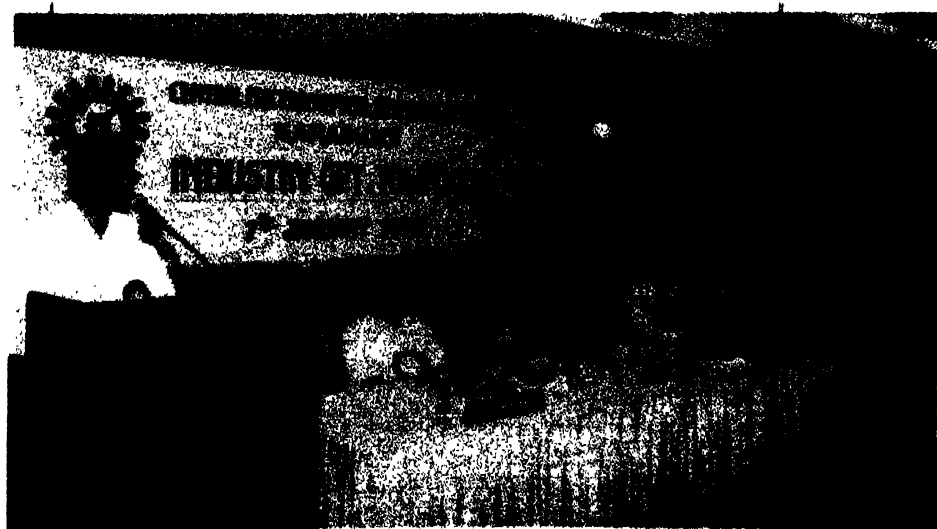
A CECRI-Industry meet was organized on 7 January 1995 at Ernakulam. Inaugurating the meet, Prof. P. Ramachandra Rao, Director, National Metallurgical Laboratory, Jamshedpur, explained the change in orientation that the CSIR national laboratories were trying to bring about following the economic liberalisation. The scientists in these laboratories, he added, were now trying to act as "marketing managers" and making all efforts to build up 'confidence' in industry that they had relevant and economically viable technologies to offer them.

Shri B.Sathianandham, Scientist, Central Electrochemical Research Institute, Karaikudi, welcomed the gathering. In his welcome address, he highlighted the achievements of CECRI. Presiding over the function, Prof. G.V. Subba Rao, Director, CECRI, emphasized the need for short and long term research and development planning for meeting the country's technology requirements as no for-

eign country would provide its frontline technology to India 'at any price'. He also highlighted the activities of CECRI headquarters and the Extension Centres.

Dr G. Prabhakara Rao, Deputy Director, CECRI, and Dr K. Gopakumar, Director, Central Institute of Fisheries Technology, offered their felicitations on the occasion. Shri T.P. Madhavan, Scientist-in-Charge, CECRI Cochin Unit, proposed a vote of thanks.

The first technical session was chaired by Shri T.V. Swaminathan, General Manager, Indian Rare Earths Ltd, Alwaye. In the forenoon sessions the following papers were presented: (1) Anti-corrosive treatment: Cement polymer coatings for steel rebar and rapid repairing technology by Shri S. Srinivasan; (2) Different protective paint coatings for different structures - know-how and consultancy services available at CECRI by Dr P. Jayakrishnan; (3) Testing facilities and other expertise at CSE Division by Dr G.Venkatachari; (4) Gold plating (different types) and other plating formulations available at CECRI by Smt. Shoba Jayakrishnan; and (5) Electro chemicals - (a) Potassium iodate; (b) Calcium gluconate; (c) Succinic acid; and (d)



Prof P. Ramachandra Rao, Director, NML, inaugurating the CECRI meet

Chlorates Perchlorates by Dr K.C. Narasimham.

In the afternoon, the research activities of CECRI were shown to the delegates on video. The technical sessions in the afternoon were chaired by Shri K.P. Thambi, Manager, Hindustan Newsprints Ltd, Mavallur, Cochin. The following three papers were presented: (1) Pollution Control and Monitoring by Dr R. Vijayavalli; (2) Batteries - Expertise available at CECRI by Dr P.N.N. Namboodiri; and (3) Activities of CECRI Cochin Unit by Smt. C.J. Indira.

More than 100 delegates from various small, medium and major industries participated actively in the deliberations. The session came to a close with a vote of thanks by Dr P.N.N. Namboodiri, Scientist, CECRI Cochin Unit. □

• Training Courses

Leakfree Pumping for Safer Future

THE Design and Engineering Division of the Indian Institute of Chemical Technology, Hyderabad, which is actively involved in the design and commissioning of chemical plants, recently organized a two-day intensive course on 'Leakfree Pumping for Safer Future'. The course was inaugurated by Dr A. Gopalakrishnan, Chairman, Atomic Energy Regulatory Board, Government of India, and attended by a large number of participants from industry as well as academic institutes.

The two-day programme included lectures by acknowledged experts in their respective fields. Three experts were from abroad. Prof. Vetter from Germany delivered five lectures. The emphasis of his lecture was on reciprocating diaphragm pump, its performance,

design, safety, reliability and applications. Prof Kato from Japan delivered three lectures on canned motor centrifugal pumps with emphasis on their design, performance, safety and protection, testing and inspection and applications. Prof Veness from the UK delivered three lectures on magnetic coupled centrifugal pumps with emphasis on their performance, design, safety, reliability, applications, cost and condition monitoring.

During the course the participants learnt and discussed new developments in the pumping industry and appreciated the environmental and safety requirements. The course material given to the participants included guidelines on applications, installation and operating procedures which would prove useful to those studying the sealless centrifugal pumps. □

Pesticide Residues

A ten-day training workshop on 'Pesticide Residues' was recently organized by the Industrial Toxicology Research Centre (ITRC), Lucknow. The event was jointly sponsored by the Commonwealth Science Council (CSC) and Council of Scientific & Industrial Research and was held under the Chemical Research & Environmental Needs (CREN) Programme. A session on Formulation of Regional Programme on Pesticide Residues was also held along with the workshop.

The programme was inaugurated by Dr S.K. Kashyap, Director, National Institute of Occupational Health, and presided over by Dr V.P. Sharma, Director, Malaria Research Centre. Participants to the workshop were from India, Bangladesh, Nepal and Sri Lanka. They were exposed to the methods of collection of samples, extraction of pesticide residues and their clean-up and quantification and confir-

mation. The workshop also included laboratory work on analysis of organochlorine pesticides in water, food material and blood. Country status reports of Sri Lanka (Dr G.R. Liyanage), Bangladesh (Dr Md. S. Haq), Nepal (Mrs Kanti Shrestha) and India (Dr P.K. Seth) were presented, and the reports received from Canada, Pakistan and Malaysia were discussed. A problem-solving session was also organized. The last two days of workshop were held at the National Institute of Oceanography, Goa, where the participants were exposed to the methods of collection and analyses of water samples for pesticide residues from marine water and marine organisms.

The valedictory address was delivered by Dr Ramasami, Regional co-ordinator, CREN programme. The closing function was presided over by Shri K.N. Johry, Director, Centre for S&T, Non-Aligned and Other Developing Countries, New Delhi. During this session certificates were given to the participants.

The session on 'Formulation of Regional Programme' was chaired by Dr P.K. Seth and Dr J.A.J. Perera in which resource persons, Dr Raghu, Dr Sethunathan, ITRC scientists and trainees of the workshop participated. The following recommendations were made after an in-depth discussion: (1) A regional programme on monitoring of pesticide residues with particular emphasis on rice, tea and marine products may be undertaken jointly by Sri Lanka, India, Bangladesh, Pakistan and Malaysia. Analysis of these residues should also be carried out in jute and jute products and leather goods; (2) There should be a constant exchange of information and technology transfer through the visits of the scientists in the participating countries; (3) A seminar on the problem of pesticide residues in exportable

commodities may be arranged in Sri Lanka in the next six months; (4) ITRC should function as the regional centre for solving the problems related to pesticide residue monitoring and provide resource

persons and guidance for getting standard reference material; and (5) Expertise of ITRC in analysis of nitrates and other pollutants may be utilized by the participating Commonwealth countries.

Repairs and Strengthening of Earthquake damaged houses

A demonstration-cum-training programme was organized by Central Building Research Institute, Roorkee, in and around Satara, Maharashtra, for about 70 engineers who will be deployed in various villages to supervise the repair of all the earthquake affected houses in the district. The financial support for repair and strengthening of the earthquake affected houses has been provided by the Government of Maharashtra.

District Satara has two distinctly different types of traditional houses: one on its high rainfall region of Kayona and the other in the low rainfall region of the rest of Satara district. As a result the repair and strengthening techniques of the houses differ in the two regions. The first part of the training

programme held in Chhatrapati Shivajee Hall of the Zilla Parishad at Satara imparted theoretical information through lectures and group discussions covering both types of constructions. The lectures were on behaviour of structures under seismic forces, repairs and strengthening methods, quality control in construction, innovative and appropriate building blocks, specifications, water-proofing, etc.

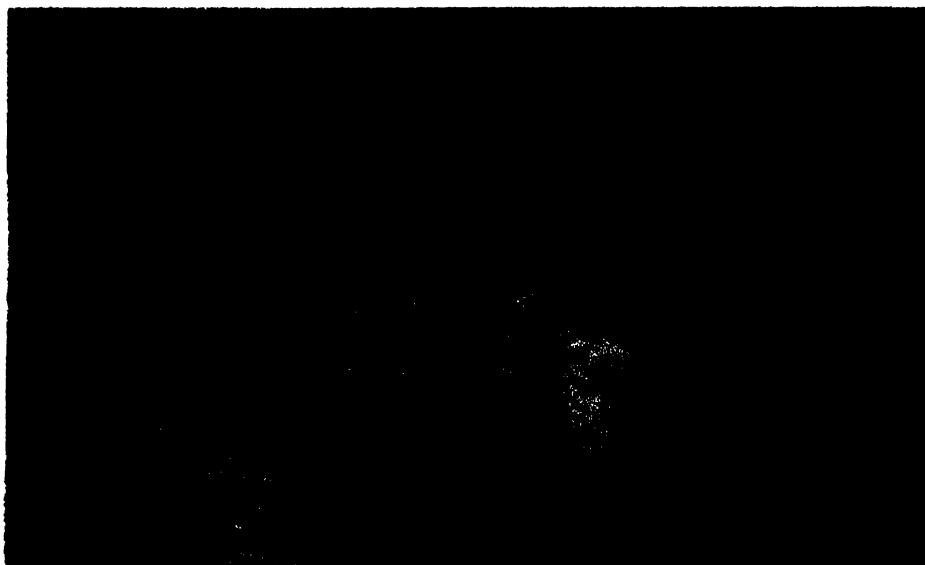
The engineers, which included about 50 newly recruited young civil engineers, were subsequently taken to different quake affected villages having suffered earthquake damages for on site discussions and demonstrations of the methodology to be adopted in repair and strengthening of the

houses. The visited villages included Mahagaon in Taluka Satara, Bibhawi and Ojhare in Taluka Medha and Metguta, Bopegaon and Bawdhan in Taluka Wai. □

Floriculture, Floral craft and Tissue culture

CSIR-PTC, Lucknow, conducted a two week Entrepreneurship Development Programme on 'Floriculture, Floral Craft and Tissue Culture' in collaboration with National Botanical Research Institute (NBRI), Lucknow, during December 1994. The subject was selected for the training because of the growing awareness and demand for preserving the environment. The programme was sponsored by Directorate of Industries, U.P., to encourage people to start small scale enterprises and generate self employment.

The programme comprised lectures on entrepreneurship, management, finance and other aspects of small scale enterprises followed by discussions, demonstrations and training on the practical aspects of floriculture, floral craft and tissue culture. Lectures were arranged in PTC Seminar Room whereas training and demonstration were organized in NBRI. Faculty for the programme was drawn from appropriate organizations and scientists of NBRI. The participants were taken around the Botanical Garden of NBRI to acquaint them with field practices used in the cultivation of Gladiolus, Chrysanthemum, Bougainvillea and other varieties of house plants. Lecture demonstrations were arranged in tissue culture laboratory on the various techniques of tissue culture now being used for vegetative propagation of flowering, ornamental and medicinal plants. The candidates were shown the methods for the dehydration of flowers and foliage and



An on-site discussion on repair and strengthening of earthquake-affected houses in Satara, Maharashtra

their use in making greeting cards, wall hangings and other decorative items. Each candidate prepared at least three items during the training. There was a good response to the training programme. On completion of the training programme certificates were given to 42 candidates along with copies of books related to the subject. The programme was inaugurated on 5 December 94 in PTC Seminar Room by Shri Pritam Singh, Commissioner, Lucknow Division. Valedictory function held in NBRI Auditorium on 23 December was presided over by Dr B.P. Singh, Deputy Director, NBRI, while Dr S.K. Jain, Emeritus Scientist, NBRI, delivered the valedictory address as the Chief Guest. □

China Porcelain for manufacture of Crockery and Novelty wares

AT the request of ceramic industries in Gujarat, the Central Glass & Ceramic Research Institute's Naroda Centre has developed a technology for manufacture of bone china wares in the small-scale sector, utilizing the china clays and chemicals available locally.

With a view to transferring this technology to the small-scale ceramic units in Gujarat, a ten-day training-cum-demonstration programme was held at the CGCRI Naroda Centre during 14-24 November 1994. Sixteen entrepreneurs representing seven units located at Naroda, seven units at Himmatnagar and one unit each at Morvi and Surendranagar, participated in the programme.

Shri M.D. Mankad, IAS, Executive Director, Industrial Extension Bureau, Government of Gujarat, inaugurated the programme. Dr K.N. Maiti, Scientist-in-Charge, Naroda Centre and Principal Investigator of the project for development of the technology, welcomed



Valedictory function of the entrepreneurship development programme on Floriculture, Floral craft and Tissue culture

the delegates and spoke about the objective and contents of the course.

The programme comprised theoretical lectures and practical demonstrations covering the following aspects: Present status of production of crockerywares in India; Characteristics of the various types of traditional ceramic wares; Basic raw materials for bone china production and their characteristics; compounding and preparation of bone china body; Characteristics of plaster of paris and Designing of moulds; Forming of bone china wares; Compounding of bone china frits and glazes; Kiln furniture and ceramic kilns; Decoration of bone china wares; Defects in bone china production and their remedies; and Testing and quality control of bone china products.

The faculty for the programme was drawn from CGCRI.

Smt. Saroj Gandhi, Managing Director, Roopal Ceramics, Surendranagar, was the Chief Guest at the valedictory function. She awarded certificates and bone china novelty wares made during the programme as mementos to the participants. Dr B.K. Sarkar, Director, CGCRI, Calcutta, presided

over the function and highlighted the various programmes initiated by the institute for the benefit of ceramic industries in the small-scale sector.

The participants spoke highly about the programme and appreciated the efforts made by the institute. They also expressed confidence in diversifying their product line into bone china production without any difficulty. □

Winners of Awards

National Mineral Award to Dr Gopala Rao

DR D. Gopala Rao of the National Institute of Oceanography (NIO), Goa, has won the National Mineral Award (1992-93) of the Ministry of Mines, Government of India, for his outstanding contributions to geophysics.

Since his joining NIO in 1971, Dr Rao has been engaged in R&D activities related to offshore oil-fields, and nature, structure and origin of the crust of Indian Ocean. He is also pursuing geophysical studies of Antarctica and Bay of Bengal Fan.

He is a member of Geological Society of India, Association of Exploration Geophysicists, Indian Geophysical Union, and several international bodies like Committee on Continent-Ocean Boundary Lithosphere Studies, International Network of Scientists on Ocean Drilling Programme and American Geophysical Union. He has been to Germany as a Carl Duisberg Gesellschaft Fellow, and to UK as an EEC Postdoctoral Fellow.



He has delivered invited lectures in universities and research organizations in France, Japan and Norway. He was a member of the Indian delegation on oceanology to Moscow during 1987-88. He has also visited Morocco, Grand Canary Islands, The Netherlands, Malta, Italy, Singapore, Crystamas Islands and Djibouti.

Dr Rao has around 45 scientific publications in reputed international/national journals, and 19 technical reports to his credit. He is a recognized Ph.D. guide of Goa and Andhra Universities. He has been member of the board of studies of various universities and Member of Expert Committee of Department of Ocean Development (DOD) on continental margin studies, Bay of Bengal Fan studies, geophysical instruments, and geological parameters.

Dr K.K. Mahajan

DR K.K. Mahajan, Scientist F, National Physical Laboratory (NPL),

New Delhi, has been selected for Shri Om Prakash Bhasin Foundation Award for Science & Technology in the field of space and aerospace for the year 1994. The award carries a sum of Rs 50,000, a memento and a citation.

Dr A.V. Narlikar

DR A.V. Narlikar, Scientist G, NPL, has been awarded the Khosla National Award-1994 of the University of Roorkee, in recognition of his research in the field of superconductivity.

Dr Ved Ram Singh

DR Ved Ram Singh, Scientist E II, NPL, has been elected as a Fellow of the Indian College of Medical Ultrasound.

Dr K.N. Raju

DR K.N. Raju, Director, National Aerospace Laboratories, Bangalore, has been elected the Vice-President of the Aeronautical Society of India.

Shri S.U.M. Rao

SHRI S.U.M. Rao, Scientist E I, NPL, has been given the Philips Award for the best electron micrograph in the category "Scanning Electron Microscopy (Physical/Material Sciences)" at the Nineteenth Conference of Electron Microscope Society of India, held at NPL during 14-16 December 1994.

Dr. N.R. Rajagopal and Shri Kuldip Chand

DR Nitya Nand, Distinguished Scientist, and former Director, CDRI, Lucknow, gave away the Society for Information Science Fellowship Awards for 1994 to the following two CSIR Information Scientists at the Inaugural function of the XIV Annual Convention and Conference on 24 January, 1995:

1. Dr N.R. Rajagopal, Head, HRD, CSIR, New Delhi
2. Shri Kuldip Chand, Scientist E I, Publications & Information Directorate, New Delhi

The Award carries a plaque and a silver medal.

S. Arunachalam

SUBBIAH Arunachalam, an information scientist at Central Electrochemical Research Institute, Karaikudi, was at the Indian Institute of Science, Bangalore, for three months as an INSA Visiting Fellow. The National Centre for Science Information played host to him. During this period, he collected data for a study on scientific developments in the People's Republic of China. □

Deputation Briefs

Shri S. Prakash Narayan

OPTIMIZATION of magnetic anisotropy of hot deformed Nd-Fe-B melt spun magnets was the research work carried out by Shri S. Prakash Narayan of the Regional Research Laboratory, Bhopal, who was deputed to the USA for a period of nine months under the Indo-US Science & Technology Fellowship programme.

He worked with the pioneer scientists Dr M.C. Koon and Dr B.N. Das. He presented his work at the thirteenth International Workshop on Rare Earth Magnets and their Applications at Birmingham, UK, and TMS Materials week 1994 at Chicago, USA.

The process developed by Shri Narayan would be useful for preparation of high energy anisotropy magnets. □

Printed and Published by Dr G.P. Phondke, Director, Publications & Information Directorate (PID), Dr K.S. Krishnan Marg, New Delhi - 110 012

Printed at PID Printing Unit

Editors : Dr B.C. Kashyap, Dilip M. Saini and Madhu Sahni

Production : Kamal Khosla

Annual Subscription : Rs. 60

Single Copy : Rs. 3.00

Phone: 5786301

Gram: PUBLIFORM

Telex: 031-77271

E-mail: pid@smetd.ernet.in

Fax: 5787082

CSIR



VOL 45 NO 5 15 MARCH 1995



IN THIS ISSUE

S.S. Bhatnagar Prizes presented 66

INSDOC makes Photo Identity Cards 68

International Reference Ionosphere 70

Major Hydrocarbon Project at RRL, Jorhat 71

Institute of Microbial Technology, Chandigarh, R & D Highlights 1993-94 72

(Top) The S.S. Bhatnagar Prize-winners with Shri Bhuvanesh Chaturvedi, the Minister of State for Science and Technology, and Prof. S.K. Joshi, the Director General, CSIR. (Bottom) INSDOC makes Photo Identity Cards — a view of the computer facility.

S.S. Bhatnagar Prizes presented

AT a glittering function organized by the Council of Scientific & Industrial Research (CSIR) at the National Physical Laboratory auditorium, New Delhi, the Minister of State for Science and Technology Shri Bhuvanesh Chaturvedi gave away the prestigious Shanti Swarup Bhatnagar Prizes and CSIR Technology Awards to scientists, engineers and technologists for the year 1994.

This year 11 scientists received the S.S. Bhatnagar Prize. The CSIR Technology Awards were given in only three fields, namely, biological sciences and technology, engineering technology, and business development and technology marketing. The last Award for business development and marketing has been given for the first time in the history of the CSIR.

Speaking on the occasion, the Minister said, "It is now becoming increasingly true that a combina-

tion of the two streams, i.e., science and technology, is a must for industrial development of any country. In our present scheme of things we have to lay equal emphasis on the promotion of science as well as technology so that our goals of economic freedom become a reality before long.

"The Technology Awards," continued the Minister, "constitute a pointer to the increasing stress that is being given to the programmes of CSIR on the basis of the present policies. Unless we come out with technologies which are nationally relevant but globally competitive, we will be crowded out by the enormous efforts made by advanced countries to globalise their markets by making available technologies at less than competitive prices to other countries.

"There is a need for our industries to realise the potential available with the R&D institutions in

our country and make use of their expertise not only for exploiting globally competitive technologies but also adding to the possibility of employment generation in a marked manner," the Minister added, "It is in this context that the institution of awards for technologies developed by CSIR assumes significance."

Earlier, Prof. S.K. Joshi, Director General, CSIR, narrated the history of the Prizes and Awards and gave an outline of the CSIR allocation for scientific research. At the end of the ceremony Prof. E.S. Raja Gopal, Director, NPL, proposed a vote of thanks.

S.S. Bhatnagar Prize winners

THE Shanti Swarup Bhatnagar Prize is India's highest and most coveted award for scientists and technologists. It was instituted in 1957 in the memory of Dr.



Shri Bhuvanesh Chaturvedi, the Minister of State for Science and Technology and Prof S.K. Joshi, Director General, CSIR, with the CSIR Technology Award winners

Shanti Swarup Bhatnagar, the founder and first head of the CSIR. The Prizes are given every year to Indian scientists and technologists who are upto 45 years of age. The Prize carries a citation, a plaque and a cash award of Rs. one lakh.

Physical Sciences

Dr. Arup Kumar Raychaudhuri of the Indian Institute of Science, Bangalore, for his pioneering experimental work in low temperature quantum transport in oxides near metal-insulator transition elucidating the interplay of disorder and interaction. For this and other tunneling studies Dr Raychaudhuri has indigenously developed state-of-the-art low temperature scanning tunneling microscope and other related experimental facilities.

Dr. Ashoke Sen of the Tata Institute of Fundamental Research, Bombay, for his pioneering work which established the connection between string theory and the conformally invariant field theories and for his recent work on the strong-weak duality which is an important breakthrough and provides a basis for further work in supersymmetric Yang-Mills theories.

Chemical Sciences

Dr Eluvathingal Devassy Jemmis of the University of Hyderabad, Hyderabad, for the exceptional effect with which he has demonstrated the application of theoretical methods to structure and reactivity of organic, inorganic and organometallic molecules, towards the comprehension of electronic and geometric structure of metallocene oligomers, metal mediated C.C. bond formation, polyhedral structural constellations and concerted organic reactions. His novel findings have already made impact on the experimental design of unusual structures.

Dr Dipankar Das Sarma of the Indian Institute of Science, Bangalore, for his outstanding contributions to the understanding of electronic structures and metal-insulator transitions and for establishing the existence of a new phase in solid state materials through high-energy spectroscopies and theory.

Mathematical Sciences

Dr. Neithalath Mohan Kumar of the Tata Institute of Fundamental Research, Bombay, for his profound and original contributions to commutative algebra and algebraic geometry. He is well known for his beautiful contribution settling the Eisenbud-Evans conjectures. Another piece of work that has received much acclaim is his paper on Rational Double Points on Rational Surfaces. His recent work on complete intersection curves settles a question of great interest.

Engineering Sciences

Dr G.Sundararajan of the Defence Metallurgical Research Laboratory, Hyderabad, for his outstanding contributions to experimental and theoretical aspects of materials engineering with special emphasis on tribological behaviour, high strain rate and high temperature deformation and fracture, impact dynamic and ballistic penetration resistance of materials.

Biological Sciences

Dr Alok Bhattacharya of Jawaharlal Nehru University, New Delhi, for his pioneering work on the identification and characterization of lipophosphoglycan and its modulation by bacterial flora and a novel species-specific calcium binding protein and its gene in *Entamoeba histolytica*. Identification of these molecules has opened up avenues to understand pathogenesis at the molecular level.

Dr Ramakrishnan Nagaraj of the Centre for Cellular & Molecular Biology, Hyderabad, for his contributions towards delineating structure-activity relationships for membrane targeting signal peptides and peptide antibiotics. His work has successfully established the separation of hemolytic and antibacterial properties in synthetic analogs of bacterial toxins leading to possibilities in rational design of antibiotic peptides.

Medical Sciences

Dr Krishna Balaji Sainis of the Bhabha Atomic Research Centre, Bombay, for his outstanding contributions to immunobiology. He has studied the role of subsets of T cells and their receptors in influencing immune response to DNA in lupus nephritis and to mycobacterial antigens.

Dr Yagya Dutta Sharma of the All India Institute of Medical Sciences, New Delhi, for his outstanding contributions to molecular biology of malaria. He has constructed a genomic library of a non-cultivable parasite — *P. vivax* — which is an important pathogen for India. He has isolated and characterized immunologically relevant recombinant antigens of *P. vivax* and *P. falciparum* which are important for the understanding of host-parasite interaction and for the development of immunotherapeutic reagents.

Earth, Atmosphere, Ocean and Planetary Sciences

Dr. Jitendra Nath Goswami of the Physical Research Laboratory, Ahmedabad, for his pioneering contributions in earth and planetary sciences, especially the formation of early solar system solids and high precision dating of single zircon crystals by an ion microprobe. □

CSIR Technology Awards - 1994

THE CSIR Technology Awards were instituted in 1990 with a view to foster and encourage in-house multidisciplinary team effort and external interaction with other constituents of the technology innovation chain for technology development, transfer, marketing and commercialisation. From 1994 the scope of the Technology Awards has been enlarged to include persons outside the CSIR system who contribute S&T inputs to the development, marketing and implementation of CSIR technology. The Technology Award for Business Development and Technology Marketing has therefore been instituted. To make the Award attractive the amount has been enhanced from Rs. 50,000 to Rs. 1,00,000. The Awards Selection Committee has been very strict this year. It has not awarded the two Shields for Engineering and Process Technology, as also the Awards for Chemical and Materials Technology.

Only three Awards have therefore been presented this year.

Award for Biological Sciences & Technology: The team at Institute of Microbial Technology (IMTECH), Chandigarh, comprising Drs Tapan Chakrabarti, P. Agarwal, U. C. Banerjee, Naresh Kumar, Sarvshree J.P. Srivastava, Paramjit, M. Yunus, S.S. Bawa and Ms Binita Saxena and at Vital Mallaya Scientific Research Foundation (VMSRF), Bangalore, comprising Drs Ashok K. Bhandari, B.Chandrashekhar, K.Shashi and Shri S. Keshavamurthy for developing a high osmotolerant and ethanol tolerant genetically modified strain of *Saccharomyces cerevisiae* for producing alcohol from molasses. The new strain has been adopted by a few distilleries resulting in significant energy savings. The collaboration effort is a fine example of a synergistic alliance.

Award for Engineering Technology: The team at Indian Insti-

tute of Petroleum (IIP), Dehradun, comprising Sarvshree H.K. Madan, Dhani Ram and P.N. Bhambi for the development of Low Air Pressure (LAP) multifuel film burner. The LAP burner enables fuel saving upto 30% with low excess air and high turn down ratio. The state-of-art burner has been exported to even industrialised countries.

Award for Business Development & Technology Marketing: Awarded for the first time to the team at Indian Institute of Chemical Technology (IICT), Hyderabad, comprising Drs A.V. Rama Rao and Shri T. Krishna Reddy for their outstanding achievements in business promotion and market development by identifying opportune areas for technology development and evolving appropriate business strategies thereby substantially enhancing IICT's earnings and credibility with the clients. □

INSDOC makes Photo Identity Cards

WELL known for the expertise in computer data processing, database creation, value-added information products, photography and reprography, the Indian National Scientific Documentation Centre (INSDOC), New Delhi, figures among the five organizations which have been assigned the task of preparing photo identity cards for the electorate of Delhi. Delhi has 70 assembly constituencies with a total of about 67 lakh voters. INSDOC is covering about 11.8 lakh electors of the 12 assembly constituencies of the South and outer Delhi. The rest are being cov-

ered by ET&T, Vijex, Deep and Techniques.

Technology option used

The production of photo I-card demands that text and graphics are combined not merely in the identity card but in the database too. Therefore, the state-of-the-art information technology has to be utilized. The technology has to provide bilingual, multiplatform facilities which operate at various locations. The Graphics and Intelligence Based Script Technology (GIST) built on the three major national standards like Indian Standard Code for Information In-

terchange (ISCII), Indian Script (INSCRIPT), Keyboard and the Indian Standard Font Code (ISFOC) meet the system's requirements. Considering the climatic factors, field conditions, availability of uninterrupted power supply, etc., in Delhi, the work was managed using a video camera and specialized add-on cards with facilities for converting photographs into digitized images.

At INSDOC a 100 member team led by Shri Prakash Chand is working round-the-clock to finish the job. The procedure adopted for making the I-cards involves: (i) Taking the photographs of the electorate by a video camera; (ii) Removing the photographs from the



field as well as data problems. The field problems were mainly due to some missing names, wrong addresses, electricity failure, non-availability of proper sites, furnitures, material management, etc. On the other hand, the data problems are the real ones which create confusion and sometimes havoc too".

Future of I cards

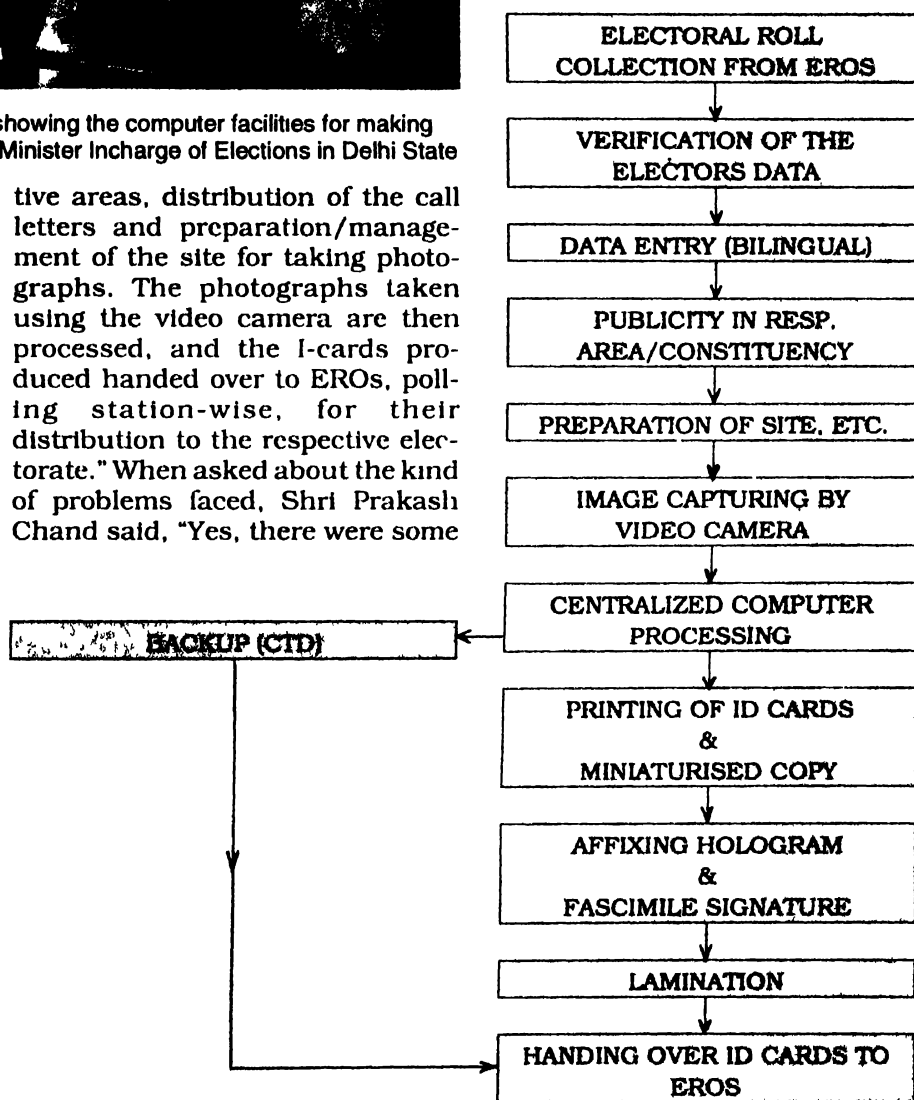
"As the I-card is produced using computer technology, computer data is in digitised form. It can be

Prof T. Viswanathan, Director, INSDOC, showing the computer facilities for making photo identity cards to Lal Bihari Tiwari, the Minister Incharge of Elections in Delhi State

video tape, making a photo file in accordance with the elector arrival numbers and electoral roll number, and merging the photo files with the personal data (bilingual) using a computer; (iii) Printing the I-cards on A-4 size sheet and A4 size miniaturised copy (for record) containing 50 photos, with required data, using a laser printer of 600 DPI; (iv) Affixing hologram, the 3-D picture of Delhi Administration emblem, on the card and stamping the facsimile signature of the Electoral Registration Officer which is the issuing authority; and finally (v) Lamination. The cards thus produced are tamper-proof.

"But making photo I-cards is not just taking photographs, merging them with personal data and printing them", said Shri Prakash Chand while explaining the project to the *CSIR News* Editor Dr. B.C. Kashyap. "In fact, the work began with the collection of electoral rolls from electoral registration officers (EROs), verification and inputting of the data, then checking and validation of input data. It was followed by engaging contractors for video-recording, publicity in the respec-

tive areas, distribution of the call letters and preparation/management of the site for taking photographs. The photographs taken using the video camera are then processed, and the I-cards produced handed over to EROs, polling station-wise, for their distribution to the respective electorate." When asked about the kind of problems faced, Shri Prakash Chand said, "Yes, there were some



Flowchart for Identity Card Project

manipulated to meet any future requirement. A complete database of the entire Delhi electorate can therefore be created and maintained in a searchable form which would be helpful in updating, revision and searching for any information about electorates. This database can also be used for various schemes of the Government. In short, a database of the entire country's electors can be maintained at national level. This database will be of immense use in conducting many useful analysis of national interest. The database of each individual state can also be put on a network which can be accessed from any corner of the country for any information," said Shri Prakash Chand. He also suggested that electorate database should be preserved and maintained on CD-ROM as keeping this data in magnetic media, i.e., on floppy or tape, is not safe. The data on CD would be safe, convenient to handling and use. He also added that creation of database and its maintenance should be handled by professional organisations keeping in view its future usefulness and compatibility. □

Workshop

International Reference Ionosphere

THE Ionosphere is that part of the atmosphere where charged particles exist in abundance and create various interesting phenomena. It extends from about 60 km upwards and affects much of the global communication these days. Broadcasting organizations and communication networks routinely require knowledge of various ionospheric parameters. The International Reference Ionosphere (IRI) has therefore been in existence for some years to give the state of the ionosphere at any location and at any time anywhere on the globe. Because of the variable nature of the ionosphere this reference ionosphere needs to be updated regularly to take care of the latest data and results. Equatorial latitudes play a very important role in defining the ionospheric characteristics. To review the current state of knowledge in ionospheric research at low and equatorial latitudes and its possible impact on the IRI, a five

day International workshop was organized by the National Physical Laboratory (NPL), New Delhi, between January 9 and 13, 1995. Fifty nine papers were presented. All presentations were oral. The workshop had "invited" as well as "contributed" papers and was attended by scientists from Brazil, Czech Republic, Japan, People's Republic of China (PRC), Poland, Republic of China (Taiwan), Russia, the U.K. and the U.S.A.

The workshop was a part of the Diamond Jubilee celebrations of the Indian National Science Academy (INSA) and was inaugurated by Prof. S.K. Joshi, President, INSA, and D.G., CSIR. In his inaugural address Prof. Joshi spoke about the genesis and the early history of INSA which was earlier known as the National Institute of Science. He also referred to the high level of research being pursued in India in the field of ionosphere for several decades starting with the pioneering work of Prof. S.K. Mitra at Calcutta. Prof. Joshi pointed out that one could assess scientific achievements made in this area from the number of ionospheric scientists being elected as Fellows of INSA. Prof. E.S. Raja Gopal, Director, NPL, welcomed the delegates and observed that the ionosphere as a subject of research is still quite vibrant even after about 100 years.

In his address Dr. D.Bilitza, Chairman, URSI/COSPAR Task Group on IRI, stated that work in IRI started more than 20 years ago and annual workshops on IRI are held to update and improve it. He stated that Indian scientists have a major role in the improvement of IRI, as ionosonde stations at various Indian centers have regularly provided ionospheric data for low and equatorial latitudes. In his address Dr. D.Anderson pointed out the important role theoretical modelling has come to play in the im-



Prof S.K.Joshi, DG, CSIR, inaugurating the workshop on "Low and Equatorial Latitudes in the International Reference Ionosphere". Seated (from left) are Drs K.K. Mahajan, D. Anderson, D.Bilitza, E.S. Raja Gopal and A.P. Mitra



15 MAR 1995

provement of IRI. Dr A.P. Mitra, F.R.S., convenor of the workshop, summarised the Indian efforts in IRI and pointed out that India has been a participant in this programme from the very beginning.

A large number of scientists from NPL participated in the workshop. Seventeen papers were presented by NPL scientists which included two invited papers, one by Dr. A.P. Mitra and the other by Dr. K.K. Mahajan

Conference

Electron Microscopy

THE XIX Conference of the Electron Microscope Society of India was organized jointly by National Physical Laboratory, New Delhi, (NPL) and Electron Microscope Society of India during December 14-16, 1994 at the NPL. The conference was sponsored by CSIR, INSA, ICMR, DOE and DST.

At the inaugural function, Prof E.S. Raja Gopal, Director, NPL, welcomed the guests and participants and gave a brief account of the importance of the electron microscopy techniques. Dr. S.K. Sharma,

Honorary General Secretary of the society, spoke about the brief history of the society and the importance of the conference. Prof. K.L. Chopra, Director, IIT, Kharagpur, inaugurated the conference. Shri Narendra Kumar of NPL proposed a vote of thanks.

180 participants from different laboratories, universities, institutions and industries attended the conference at which about 100 papers dealing with materials science and biological/medical sciences were presented in two oral presentation sessions which ran in parallel. The only common session for both the disciplines was devoted to instrumentation and techniques. Representatives of Leica Cambridge Ltd. (U.K.) and Philips, Holland, gave lectures on the developments of their new models and their capabilities. Indian representative of M/s Jeol, Japan, gave an account of various models of their electron microscopes available for different applications. One of the representatives of DST described briefly the effort made by Indian institutes to develop scanning electron microscope. He also gave specifications of the available instruments.

Invited speakers in the area of materials science spoke on the topics of current interest and latest techniques being used with electron microscope. These subjects included the quasi-crystalline phases, growth and structure of diamond thin films, CuInSe₂ film solar cells, SEM studies of calcified bio-mineralised tissue, developments in electron beam instruments and electron energy loss spectroscopy as an important analytical technique. In the field of biological/medical sciences, the invited lectures were devoted to important issues such as application of SEM/TEM to hydrocephalus and malaria research, controversy in rhinosporidiosis settled with electron microscopy, ultrastructure of atherosclerosis, and diagnosis of viral diseases of plants by electron microscopy.

A souvenir containing abstracts of the papers presented at the conference was also brought out on this occasion. At the General Body meeting held on 15th December 1994, Dr. S.K. Sharma, Scientist 'F', NPL, was elected as the President of the Electron Microscope Society of India for a tenure of two years, 1995 and 1996. □

Institute of Microbial Technology, Chandigarh R&D Highlights: 1993-1994

THE year 1993-94 has been very encouraging in the sense that the Institute of Microbial Technology (IMTech), Chandigarh, achieved marked progress in every sphere of its activity. First, this was the year when its technology package on High Alcohol Yeast, which was jointly developed with Vittal Mallya Scientific Research Foundation, Bangalore, was transferred to McDowell group of distilleries. Also IMTech could successfully in-

troduce a flocculent character in this yeast strain so as to make it suitable for use in continuous mode of fermentation.

Secondly, IMTech developed a highly reproducible process for the purification of the recombinant blood clot dissolving enzyme, streptokinase, from crude broth, which has greatly facilitated its isolation and purification on a large scale. Thirdly, IMTech identified an organism which produces glutaryl-

7ACA acylase extracellularly. This enzyme has now been purified and immobilized, achieving over 90% conversion of glutaryl-7ACA into 7 ACA.

Apart from the above, significant progress has been made in its R&D programmes on basic immunology and cholera genetics. A 150 kDa molecule on the macrophage surface and three molecules (155 kDa, 105 kDa and 37 kDa) on the B-lymphocyte surface have been

identified as novel co-stimulatory molecules which selectively activate TH-1 and TH-2 cells respectively. Besides, the clonality of V.cholerae 0139 isolates was established and it was predicted that the new epidemic strain 0139 has evolved from 01 El Tor strains. This progress on both the applied and basic research fronts has resulted in about two dozen research papers and half a dozen patents.

All the national facilities, viz., Biochemical Engineering Research and Process Development Centre (BERPDC), Microbial Type Culture Collection Centre (MTCC), and Distributed Information Centre (DIC), located in this institute, continued to serve the Indian scientific community as usual. The MTCC now has over 3000 microbes, and the facility is being optimally utilized by both the scientific community and industry. Similarly, the fermentation facilities have been utilized by the Indian industry, e.g. SPIC, Science Foundation, Madras, as well as R&D institutions like International Centre for Genetic Engineering and Biotechnology, New Delhi, and Indian Institute of Science, Bangalore.

During the stated period, IMTech had a few more sponsored projects from other government agencies and had also earned some money from private sector industry.

During the stated period work on various research and development oriented projects continued apace; brief reports on these projects, arranged area-wise, are given below.

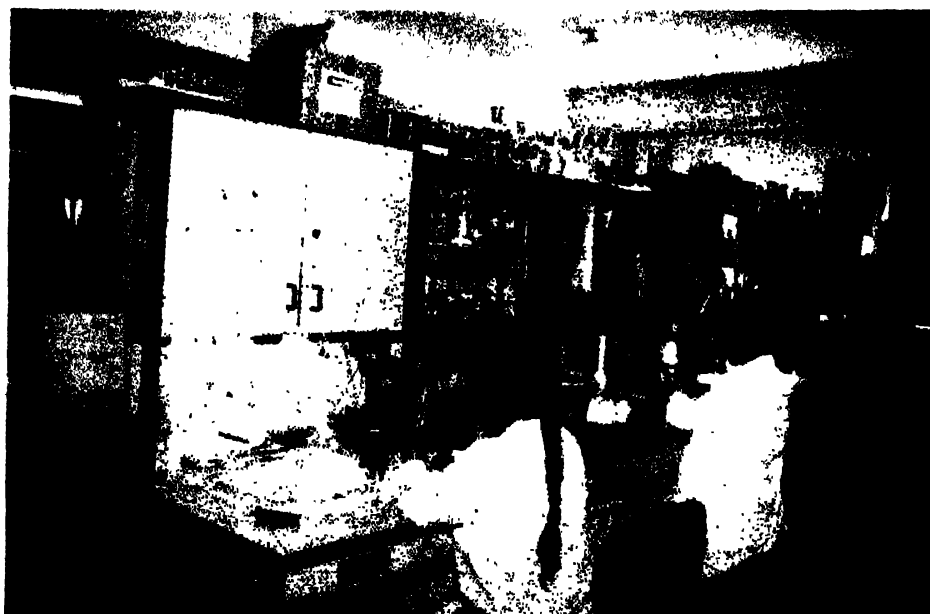
Molecular Biology

In the area of molecular biology, microbial genetics and microbiology, there are several projects under way. One project aims at understanding the regulation of gaseous hydrocarbon metabolic pathways at the genetic level. Metabolism of propane, butane, pentane and hexane by three representative bacteria will be examined by genetic and molecular biological techniques to see if there is a commonality of mechanisms in different bacteria as well as for utilisation of different hydrocarbons by a single strain of bacteria.

During the period a genomic library of IMT 37 in a cosmid vector was constructed. A total of 40 kb

Objectives of IMTech

- To provide integrated research, development and design base for microbial technology
- To undertake basic and applied research and development programmes in established and newly emerging areas of relevant biotechnology including genetic engineering
- To optimise the existing microbial processes currently available and in use in the country
- To develop and maintain gene pool resources and genetic stocks of microbial cultures and other cell lines. This could also serve as a reference centre to assist other centres.
- To establish facilities for biochemical engineering instrumentation development, including microprocessor systems, a computer centre and development of mathematical models for process parameters.
- To establish facilities for design of process equipment and bioreactors.
- To impart training in microbiology, microbial technology and biochemical engineering.
- To conduct training and refresher courses for research workers and technologists.
- To establish documentation and information retrieval and dissemination facilities and a data bank to meet the needs of the Institute.
- To establish and maintain effective linkages with industry and educational institutions.
- To develop capabilities for producing design and engineering packages for industrial plants. □



A view of an IMTech laboratory

DNA fragments around a 4.9 kb hydrocarbon specific region were isolated and based on tentative restriction maps of these fragments subclones were generated. These subclones are to be tested for complementation of the mutant phenotypes.

Another hydrocarbon specific protein (32 kDa) was purified from *Rhodococcus* sp. IMT 35 and antibody raised against it. Its specificity was shown by western immunoblotting. It is planned to use the antibody for immunoscreening of a genomic library.

The objective of another project is to isolate and identify bacterial strains which are capable of producing biosurfactants using cheap substrate as carbon source. The biosurfactants will be characterised, and genetic basis for their formation will be investigated. Also, their use in the remediation

of insoluble organic pollutants in soil and industrial wastes will be studied.

Five bacterial strains were selected for detailed studies on production of surface active compounds after an extensive study of the Gujarat Oil microorganisms. These five isolates lower the surface tension of the culture broth to about 26 dynes/cm indicating the synthesis of biosurfactants. Examination of cells grown on hydrocarbon revealed the appearance of vesicles. The five strains have been identified upto species level. A medium rich in NaNO_3 and Na_2HPO_4 was developed which promoted good growth of the cells and high yield of the amphiphilic compounds. The biosurfactants are active over a wide range of pH and temperature. It was ascertained that the synthesis of biosurfactants is plasmid mediated.

Another project in progress aims to examine the *V. Cholerae* O1 and non-O1 strains from the environment and infected patients from National Institute of Cholera and Enteric Diseases (NICED) and elsewhere for the presence of CT operon and genes for other secretory factors; development of DNA probes making use of the sequence information available in the literature using PCR techniques; study of the regulation of toxin gene expression in such isolates; and to develop a suitable strain from these as a live oral vaccine.

Vibrio cholerae belonging to the O1 serogroup are responsible for the disease cholera and possess epidemic and pandemic potential. In contrast, the other serogroups of *V. cholerae*, collectively known as the non-O1 serogroups, are associated with sporadic cases of gastroenteritis and extra intestinal infections but do not manifest an



A view of the computational facility at IMTech's Information Center

Model-making Unit at IITech

MATHEMATICAL Modelling Unit was set up in October 1992 to promote mathematical work in the biological sciences. During the year under report, studies on mixing and parametric sensitivity in fermentations using recombinant bacteria were conducted. These two features are important in pilot and production scale ferments, where perfect mixing is difficult to achieve and process disturbances are often inevitable. Unlike large volume and low cost products, those from recombinant strains are produced in comparatively low concentrations, require good purification techniques, and are expensive.

The inherent instability of cells containing the plasmid which generates the recombinant protein makes fermentations using these cells sensitive to the fluid mixing pattern and process disturbances. Because many recombinant processes are operated in a batch or fed-batch mode, the performance and the sensitivities are time-dependent. For maximum productivity, therefore, the degree of micromixing and macromixing should be varied as fermentation progresses. Mathematical models have been developed and solved for such problems based on experimentally validated kinetics for *E. coli* cells containing the plasmids pOU140 (coding for β -lactamase) and pPLc23trpAl (coding for typtophan synthetase).

epidemic potential. However, since October 1992, a typical cholera-like outbreak caused by strains of *V.cholerae* that do not agglutinate with the O1 antiserum started in Madras and soon spread to different parts of India and Bangladesh. In Calcutta alone, 13,275 cases were reported between January and April 16, 1993. These strains from India and Bangladesh were found to be serologically identical and were therefore assigned a new serogroup O139 with a synonym Bengal.

The genesis of the novel strain *V. cholerae* which appears to have epidemic and pandemic potential has evoked global interest. Never before in the recorded history of the disease, a cholera epidemic has been caused by a non-O1 strain. The way the new strain evaded the preexisting immunity against serogroup O1 prevalent in a cholera endemic population aroused great concern. There is already a great deal of speculation on whether the new strain, recently assigned to the serogroup O139, is a mutant of the O1 serogroup.

Working in collaboration with Dr. R.K. Ghosh of Indian Institute of Chemical Biology (IICB) and Dr. G.B. Nair of National Institute of Cholera and Enteric Diseases (NICED), Calcutta, several new findings were made through an RFLP analysis of a large number of isolates: (a) clonality of O139 isolates was established; (b) the new epidemic strain O139 derived from O1 El Tor strains was predicted for the first time. Intermediate strains which occurred in the transition from O1 to O139 were also identified. These strains had novel attributes and were neither truly classical nor truly El Tors; (c) in O139 strains the cholera toxin gene exists in multiple copies was demonstrated; (d) it was found that a large number of O139 strains carry plasmids and many are lysogenic.

RFLP analysis of 76 epidemic isolates of *V.cholerae* O139 and non-O139 was carried out with multiple restriction endonucleases to investigate the epidemiological spread. In addition, efforts were made to develop a potential vaccine; a large number of strains were scanned for their ability to colonize well and also for their lack of reactogenicity. A strain of *V. cholerae* O1 was found, which is an excellent colonizer and is devoid of the entire toxin cassette, as determined by the southern hybridization. To develop this into a potential vaccine, efforts have been made to introduce the immunogenic subunit B of the cholera toxin into the chromosome of the strain.

Tissue Culture

In the area of animal cell/tissue culture, the project which was successfully completed during 1993-94 was regarding the regulation of the immune system. It could achieve its desired goals of understanding the cellular basis of action of immunomodulators, and develop B, and T or T cell subset specific immunopotentiator suppressor.

Techniques were developed to isolate antigen specific B-cells and also to clone antigen specific Th-1 and Th-2 types of T helper cells. Similarly, proteins isolated from the surface of macrophages and LPS activated B cells by SDS-PAGE were functionally reconstituted into phosphatidylcholine (PC) vesicles and screened for their potential costimulatory activity in presence of anti-CD3 as a source of cross-linker to T cell antigen receptor (I signal).

Another project aims to develop a system for antibody mediated selective delivery of cytotoxic compounds (antimalarial/hemolytic) to malaria-infected erythrocytes. The following was achieved during the period under report:

Use of specific polyclonal and monoclonal antibodies in recognizing malaria infected erythrocytes was found highly effective in targeting antimalarial compounds (Chloroquine) to the infected erythrocytes. Attempts were then made to test the feasibility of using the above approach to *P. falciparum* infected erythrocytes, leishmania infected macrophages, and tuberculosis infected macrophages.

To raise mouse monoclonal antibodies (MAbs) against *P. falciparum* infected erythrocytes, *in vitro* culture for *P. falciparum* was made in the lab. In the meantime, MAbs raised against *P. berghei* infected erythrocytes were tested for the cross reactivity with *P. falciparum* infected erythrocytes. This work was done in collaboration with ICGB, New Delhi. Two MAbs were found cross reactive with *P. falciparum* antigen (s), while two others were highly specific to *P. berghei* infected erythrocytes. This showed that some of the raised MAbs recognize the conserved epitope(s) in malaria infected erythrocytes. Attempts are now being made to generate MAbs against *P. falciparum* infected erythrocytes and to extend this approach to leishmania and tuberculosis infected macrophages.

Another project aims to study the biochemical roles of cytokines and other cellular products in the pathogenesis of mycobacterial diseases.

During the period under report, interleukin-1, a cytokine produced by macrophages, has been found to enhance the growth of *M. microti* within a murine macrophage cell line J774. The effect of IL-1 α was found to be mediated by cAMP. Interestingly, two other cytokines, interferon - α and tumor necrosis factor - γ , were found to reduce the growth of *M. microti* in macrophages. IMTech studies indicate

that cytokines have bidirectional effects on the growth of the *M. microti*. It is also proposed to identify the cytokine which enhances or reduces the growth of *M. microti*, a known tuberculosis pathogen, and the probable mechanism leading to its activity.

The major objective of another project is to study on a long term basis the role of membrane-associated cytoskeleton in regulating the yeast membrane structure and function, and to evaluate the suitability of yeast membrane lipids for delivering macromolecules to cell cytosol.

(i) *Membrane structure and function*: The transbilayer phospholipid distribution in plasma membrane of yeast has been determined by treating the spheroblasts with the amino-group labelling reagents, viz., trinitrobenzenesulphonic acid (TNBS) and fluorescamine. Conditions were established under which these

probes did not permeate through the membrane and labelled only the external phospholipids in intact spheroblasts. The amounts of amino phospholipids that were present in the outer leaflet of the membrane bilayer were found to be similar using both the probes.

Several attempts were made to use phospholipase A₂ from different sources as the external membrane probe to determine the glycerophospholipid distribution across the yeast plasma membrane. This enzyme did not degrade yeast phospholipids in intact spheroblasts under a variety of conditions, but it readily hydrolyzed various phospholipids in cell lysates.

(ii) *Macromolecule delivery systems*: Studies on development of a system which can deliver proteins to macrophage cytosol have given encouraging results. Liposomes formed from a specific fraction of yeast lipids were found to be suit-

IMTech Information Centre

URING the year under report the Distributed Information Centre on Enzyme Engineering, Immobilized Biocatalysts, Microbial Fermentation and Bioprocess Engineering undertook the following activities:

Software Development : (i) A software DNASIZE was developed for computing the size of DNA fragments from their electrophoretic mobilities using a graphical method; (ii) Another software GMAP was developed for (a) mapping the potential restriction endonuclease (R.E.) sites in non-ambiguous DNA sequence, (b) searching all R.E. sites in ambiguous DNA sequence, and (c) for searching R.E. sites in DNA sequence obtained from reverse translation of amino acid sequence employing user defined

codon usage; (iii) Ab-Affi computer program was developed for computing affinity of monoclonal antibodies. This programme is based upon law of mass action and is used for calculating affinity of a monoclonal antibody using non-competitive ELISA.

Services: (i) E-mail facility and computational help was provided to the users for analysing protein and nucleic acid sequences, to predict secondary structure of proteins, to access protein databank, PIR Gene Bank, etc., from mail servers; (ii) News facility was extensively used by users from within the Institute as well as from outside; and (iii) Literature Search was conducted for users both from within and outside Chandigarh.

able for delivering ovalbumin to the macrophage cytosol, as determined by several methods, such as fluorescence light microscopy after using both water soluble and lipid soluble probes and cell fractionation. About 30-35% of the protein was delivered to the cytosol by this procedure. The delivered protein was found to elicit strong cytotoxic T-lymphocyte response, as determined by both dye release and ^{51}Cr release assays.

Protein Engineering

In the area of protein engineering, two projects are in progress. One project intends to: (a) clone streptokinase (*skc*) gene in *E. coli* and construct recombinant strains for hyper-production of streptokinase; and (b) develop an efficient and improved strain of *Streptococcus* for streptokinase production.

Cloning and expression of streptokinase (*skc*) gene in *E. coli* was reported earlier. Expression of *skc* gene through its natural regulatory signals resulted in relatively low level of extracellular SK production in *E. coli*. Additionally, due to constitutive *skc* gene expression, cells accumulated unprocessed SK intracellularly in an unregulated fashion, creating toxic effects on the host cells. During the period under report efforts to maximize *skc* gene expression and secretion in *E. coli* were made. Using gene cloning techniques, a DNA fragment carrying entire SK structural gene was fused in frame with OmpA signal sequences and cloned under the control of tac P promoter. Resulting plasmid construct pJKD.55, when introduced into *E. coli*, displayed several fold increase in the extracellular release of SK after IPTG induction. To explore the wide range of bacterial hosts for high level protein secretion and stability, several bacterial hosts were tested which indicated marked variability with respect to

protein secretion ranging from 1500- 3000 u/ml into the extracellular medium. *E. coli* strains showing maximum streptokinase secretion were selected and condition for optimal growth, SK induction and secretion were standardized at shake flask level. Using purified streptokinase as standard, extracellular recombinant SK was characterized by zymography which indicated its molecular weight of about 47 kD similar to native SK. A 44 kD degradation product also appeared in the zymograph and was found active with respect to plasminogen activation. *Skc* gene was further characterized by nucleotide sequence analysis. Experiments are now under way to investigate the mechanism of SK processing and secretion in *E. coli*.

A novel affinity matrix (Plasmin-TLCK-agarose) has been developed for SK purification using a covalently modified derivative of plasmin. The matrix has been optimized to obtain an affinity based process that purifies recombinant SK in approximately 60- 70% yield at milligram levels. The overall process produces SK that is homogeneous by SDS-Page, and displays a specific activity comparable to the most highly purified SK samples available internationally. The process is currently being scaled up prior to detailed drug testing of recombinant streptokinase. Fermentations of a *E. coli* strain carrying recombinant plasmid pJKD55 were carried out in a 2.5l fermenter. Environmental factors, viz., pH, temperature, RPM, aeration were optimised. Currently, the activity obtained was more than double when compared to shake flask experiments. The protein stability 12-14 hours after fermentation varies from 0 to 60%. Plasmid stability was 95-100% at the end of a low density fermentation. Plasmid loss is detected at higher cell den-

Microbial collection & Gene bank — a national facility

AT present the collection at IMTech holds about 3000 cultures in its stock. During the period under report a total of 718 cultures were supplied to investigators in academic institutions and industrial houses. More than 100 unknown microorganisms (bacteria, fungi, yeast, actinomycetes) were identified by scientists of this National Facility. Like previous years, many researchers from different parts of the country used the lab facility for their research or training. □

sities. Efforts are on to minimize this loss.

The second project aims at isolation, molecular cloning and optimal expression of the gene coding for bovine growth hormone (bGH) for producing the biologically active protein in large quantities in pure form.

IMTech had earlier reported the successful cloning of this gene using a RNA-PCR approach. The gene has now been characterized by complete nucleotide sequencing and expressed in *E. coli*. By careful redesign of its control elements, the expression of the gene has been optimized to obtain approximately 100 mg/litre of the recombinant hormone. Since this level of expression is seen in shake-flask cultures with relatively low level of cell-growth (0.5 OD₆₀₀ units), it is apparent that gram quantities of the hormone can be expected in cultures grown under optimized and controlled conditions of fermentation. The gene coding for the growth hormone of the Indian water buffalo, the principal milch animal in India and other Asian countries, has similarly been cloned and hyper-expressed in *E.*

coli. The recombinant hormones are currently being characterized physicochemically.

Fermentation Technology

In the area of fermentation technology, one project intends to develop a microbial process for the generation of 7-ACA nucleus from cephalosporin C.

The work on Glutaryl-7ACA acylase was continued with attempts being made to optimize the phase of production where a predominant acylase and little, if any, esterase activity could be obtained and such a medium and phase ascertained. The whole cells at this stage could be immobilized and used for four cycles without any decline in activity. However, a major breakthrough was achieved when a variant which produced the acylase extracellularly was found. This is an extremely significant finding as no organism producing an extracellular acylase has been reported to date. It also has the added advantage of doing away with associated intracellular esterase activity. The enzyme has been partially purified and attempts to purify it to homogeneity are on.

On further study the enzyme has been found to have a pH optimum of 8.5 and a temperature optimum of 40°C. It has been successfully immobilized on an inorganic polymer and further studies on its characterization are being pursued.

Another project intends to develop a process for the production of alkaline proteases at pilot plant level, including downstream processing for its recovery.

This screening programme for alkaline protease producers was intensified, and soil and water samples from a variety of sources were screened. A strain identified as *Bacillus sphaericus* was found

to be very good producer of alkaline protease. Experiments were carried out for optimisation of protease production, stability of enzyme was checked at different temperatures, pHs and in presence of locally available detergents. The work on media optimisation indicated that the organism utilised starch, lactose, sucrose, maltase, glucose and many other carbon sources for protease production. The effect of various commercial grade nitrogen sources such as protose paste, soyabean meal, soyatose and casitose on enzyme production was studied and found to be suitable for protease production. Further work is in progress to use a combination of carbon and nitrogen sources to optimise protease production. It was observed that sodium carbonate produced best result to set pH. The effect of aeration and agitation on enzyme production is under investigation.

Separation of cell mass from fermented broth was done initially by centrifugation and then the enzyme was concentrated by ultrafiltration. Later, proteases were precipitated by using either sodium or ammonium sulphate. A typical increase in specific azocaseinase activity of more than 2000 units/mg of protein was obtained using ammonium sulphate precipitation. Further work on optimisation of various separation parameters to maximise enzyme yield is in progress. The stability of crude alkaline proteases using various commercial washing detergents was investigated. Washing tests (qualitative visual observation) using various detergents along with the enzyme were carried out for blood, milk tea and pickle oil strains. The visual observation showed increased efficiency in presence of this enzyme.

Another project aims at developing novel molecular and bioprocess strategies to enhance

recombinant plasmid stabilities during batch, fed-batch and continuous fermentations; study the effects of environmental conditions and media composition on the kinetics of growth in relation to plasmid stabilities; improve host genotype and/or gene expression; integrate the recombinant plasmid into host genome; and design efficient methods to separate plasmid harbouring cells from the plasmid free ones.

During the year under the report, batch, fed-batch and continuous fermentations using various strains of *bacillus* and *E. coli* containing a recombinant shuttle plasmid pCPPS-31 were carried out.

The recombinant shuttle plasmid pCPPS-31 [confers CMCase production and neomycin resistance] was segregationally, and not structurally, unstable both in *B. subtilis* (50-60%) and *E. coli* (80-90%) when grown in serial batch cultures for 72 hours. The plasmid showed 80-100% segregational and complete structural stability in *B. subtilis* during batch, fed-batch, and continuous culture fermentations in minimal M9 medium. In *E. coli* the instability was more than 50% in 36 hours of batch or continuous culturing and approached 100% in 72 hours of continuous fermentation. The plasmid was more stable during fed-batch fermentation. Stability in *B. subtilis* and instability in *E. coli* may be attributed to: (i) the significant growth rate advantage of plasmid free cells over plasmid harbouring cells in the case of *E. coli*. This advantage was absent in *B. subtilis*; and (ii) the existence of plasmid in oligomeric forms in *E. coli* and mainly monomeric forms in *B. subtilis*. □

Honours & Awards

R.A. Mashelkar

DR. R.A. Mashelkar, Director, National Chemical Laboratory, Pune, gave the P.V. Danckwerts Memorial Lecture on 'Seamless Chemical Engineering Science: The Emerging Paradigm' at Glaziers Hall, London. Founded in recognition of the contributions made by Prof. P.V. Danckwerts in pursuit of scholarship in chemical engineering, Dr. Mashelkar's lecture was the ninth in the series of annual lectures. The lecture series is sponsored by Pergamon (an imprint of Elsevier Science publications), in association with the Institution of Chemical engineers, UK.

He was also awarded the "Raj Kristo Dutt Memorial Award" for 1994-95 by the Indian Science Congress Association (ISCA), Calcutta. The award carries a cash prize of Rs. 10,000 and Dr. Mashelkar delivered a lecture related to the focal theme of the session, "Science, Technology and Industrial Development in India", at the 82nd Annual Session of ISCA held between January 3 and 8, 1995. The award was given to Dr. Mashelkar in recognition of his efforts to bring science and technology together. ISCA also honoured him with the prestigious Jawaharlal Nehru Birth Centenary Lectureship for 1995.

Dr. Mashelkar has also been elected Vice President of the Indian Academy of Sciences, Bangalore.

T.N. Singh and U. Kumar

DR T.N. Singh, Scientist G, CMRI, and Shri U. Kumar, Chairman-cum-Managing Director, SECL, Bilaspur, have been awarded the Coal India Prize, J.G. Kumaramangalam Memorial Award 1993-94, by the Institution of Engineers (India) for their paper entitled "Technical Innovations for Upgrad-

ing Productivity in Indian Coal Industries".

C.N. Ghosh and A.K. Ghose

DR C.N. Ghosh, Scientist, CMRI, and Prof. A.K. Ghose, Ex- Director,

ISM, Dhanbad, have bagged the Hindustan Zinc Limited Prize 1993-94 for their paper entitled "Design of Support Systems for Board and Pillar Workings in Indian Coal Industry - A Synthesis.

ANNOUNCEMENTS

Training Programmes/Refresher Courses at CRRI

The Central Road Research Institute, New Delhi, will be organizing the following training programmes/refresher courses during 1995-96:

S.No.	Refresher Course/Training Programme	Period	Course Fee
1.	Refresher Course in Highway Engineering	12 April-12 May 1995	Rs 4000
2.	Training Course on Use & Maintenance of Automatic Road Unevenness Recorder/Profilograph/Bump Integrator and Introduction to other Related Devices	7-13 June 1995	Rs 1000
3.	Training Programme on Rural Road Technology & Soil Stabilization	21-27 June 1995	Rs 1000
4.	Training Programme in Elastomeric Bearings for Bridge Design Engineers	5-11 July 1995	Rs 1000
5.	Training Programme on Roads and Embankment on Soft Grounds	26 July -1 August 1995	Rs 1000
6.	Refresher Course in Traffic & Transportation Engineering	16 August-6 September 1995	Rs 3000
7.	Refresher Course for Senior Highway Engineers	20 September-11 October 1995	Rs 3000
8.	Refresher Course on Bridge Engineering	25-31 October 1995	Rs 1000
9.	Training Programme in Procedures of Material Testing & Quality Control Techniques of Highway Construction	15 November -6 December 1995	Rs 3000
10.	Training Course on Use & Maintenance of Automatic Road Unevenness Recorder/Profilograph/ Bump Integrater and Introduction to other Related Devices	13-19 December 1995	Rs 1000
11.	Training Programme on Design, Construction, Quality Control & Maintenance of Bituminous Surfacing of Roads and Runways	7-20 February 1996	Rs 2000

D.N.Gupta

SHRI D.N.Gupta, Senior Technical Assistant, Publications & Information Directorate(PID), New Delhi,



was awarded the Gold Medal for having stood first in the 35th vocational training course in Typography, Desktop Publishing and Typesetting organised/conducted by Delhi Printers' Association, New Delhi. The course was sponsored by the PID.

B.R. Nijhawan

BANARAS Hindu University conferred the Degree of Doctor of Science, *Honoris Causa*, on Dr. Bal Raj Nijhawan at the XVII Convoca-



tion of the Institute of Technology. He was the first Indian Director of the National Metallurgical Laboratory, Jamshedpur. Dr Nijhawan has made many invaluable and lasting contributions to the field of metallurgy and materials science. He has pioneered research and de-

velopment work on armour plate technology, armour failures and control of austenitic grain-size of steels- all related to the defence needs of our country. He has also been responsible for research and development of production technologies of alloy steels from indigenous raw materials including the world-acclaimed nickel-free austenitic stainless steels. As an outstanding leader in the metallur-

gical profession, Dr. Nijhawan has been responsible for establishment of 25 internationally renowned "Centres of Metallurgical Engineering" and several mineral and metallurgical R&D centres in many developing countries through UNIDO. He is also recipient of several national awards and honours, including the S.S.Bhatnagar Prize and Padmashri. □

फॉर्म 4/FORM IV

[नियम 8 देखिए/(See Rule 8)]

1. प्रकाशन स्थान/Place of publication
2. प्रकाशन अवधि/Periodicity of its publication
3. मुद्रक का नाम/Printer's Name
(क्या भारत का नागरिक है?)/(Whether citizen of India?)
(यदि विदेशी है तो मूल देश)/(If foreigner, state the country of origin)
पता/Address

New Delhi
Semi-monthly
Dr G P Phondke
Yes

Publications & Information
Directorate, Dr K.S. Krishnan
Marg, New Delhi 110 012

Dr G P Phondke
Yes

4. प्रकाशक का नाम/Publisher's Name
(क्या भारत का नागरिक है?)/(Whether citizen of India?)
(यदि विदेशी है तो मूल देश)/(If foreigner, state the country of origin)
पता/Address

As above in (3)
Dr B.C. Kashyap
Yes

5. संपादक का नाम/Editor's Name
(क्या भारत का नागरिक है?)/(Whether citizen of India?)
(यदि विदेशी है तो मूल देश)/(If foreigner, state the country of origin)
पता/Address

As above in (3)

6. उन व्यक्तियों के नाम व पते जो समाचार-पत्र के स्वामी हों तथा जो समस्त पूंजी के एक प्रतिशत से अधिक के सझेदार या हिस्सेदार हों।
Names and addresses of individuals who own the newspaper and partners or share holders holding more than one per cent of the total capital.

मैं, _____, एतद्द्वारा घोषित करता हूँ कि मेरी अधिकतम जानकारी एवं विश्वास के अनुसार ऊपर दिए गए विवरण सत्य हैं।

I, Dr. G. P. Phondke hereby declare that the particulars given above are true to the best of my knowledge and belief.

ता०/Dated 15 March 1995

Sd/- G P Phondke
प्रकाशक के हस्ताक्षर/Signature of Publisher

Printed and Published by Dr G.P. Phondke, Director, Publications & Information Directorate (PID), Dr K.S. Krishnan Marg, New Delhi - 110 012
Printed at PID Printing Unit

Editors : Dr B.C. Kashyap, Dilip M. Salvi and Madhu Sahni

Production : Kamal Kishore

Annual Subscription : Rs. 60
Single Copy : Rs. 3.00

Telex: 041-77371

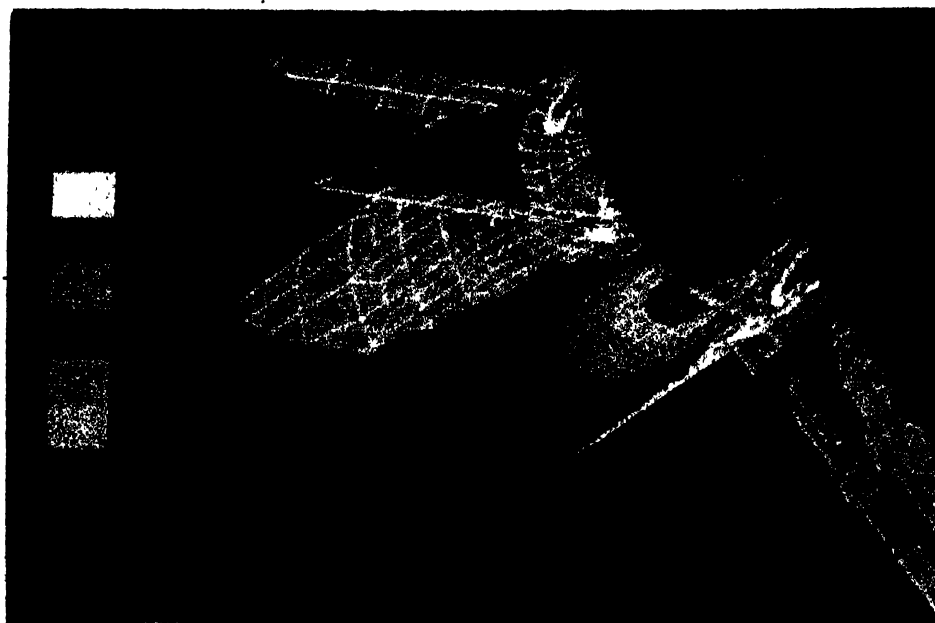
E-mail: pid@nic.net Fax: 5787082

CSIR

NEWS



VOL 45 NO 6 30 MARCH 1995



IN THIS ISSUE

Structural Engineering Research
Centre, Madras
R & D Highlights: 1993-94

82

Ornamental Plants, a Lucrative
Industry

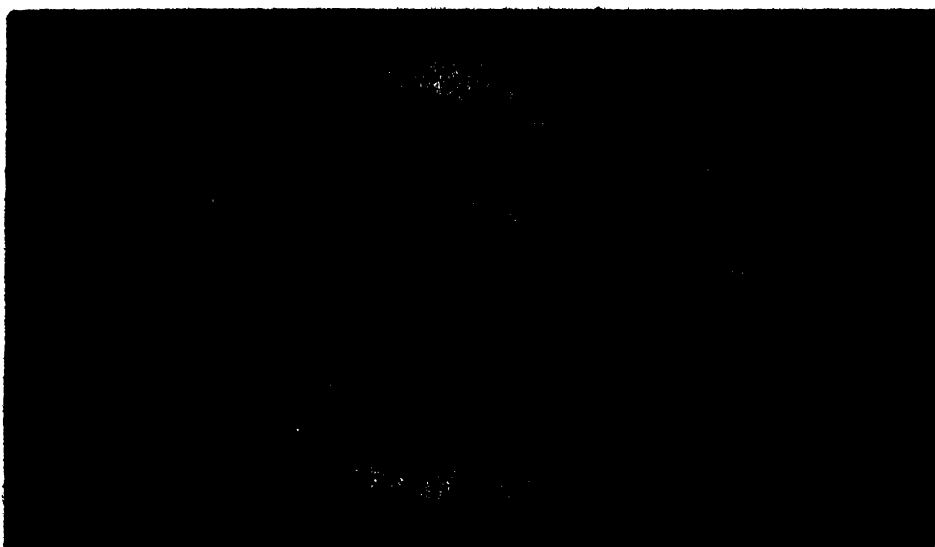
82

Fly ash Utilisation

93

Polymer Modified Binders for
Roads and Airfields

94



Stress contours in a
multi-planer tubular joint
- a study conducted at
SERC, Madras (Top). The
best rose 'Doris
Tystermann' exhibited at
Rose and Gaidiolus
show organized by
National Botanical
Research Institute,
Lucknow (Bottom).

Structural Engineering Research Centre, Madras R & D Highlights: 1993-94

SEVERAL R & D projects and sponsored research projects were either successfully completed or taken up at the Structural Engineering Research Center (SERC), Madras, during 1993-94. A large number of public and private sector departments/ organisations continued to seek the centre's expertise for solving the technical problems faced by the industry. 87 consultancy assignments were undertaken by the centre during the year. Ten different towers, besides 400 kV 'V' & Quad strings, were tested at the Tower Testing and Research Station (Trisulam), for end users like State Electricity Boards, Department of Telecommunications, Power Grid Corporation, and Ontario Hydro, Canada. 46 software packages for structural analysis and design were released during the year to various government agencies, public sector undertakings and the private sector, taking the cumulative number of

packages released to an impressive 381!

For the first time in the history of this research centre, the external cash flow during the year has crossed the rupees one crore mark amounting to almost 30 % of the CSIR grant for the year. The centre has geared itself with state-of-the-art facilities and proven high level technical expertise for successfully handling important industry- and economy-oriented projects in the coming years which are likely to throw up new structural engineering challenges in the country in the face of liberalised national economy and globalisation. Given below are some important R&D highlights of different projects taken up at the centre.

Fatigue in Offshore Structures

The aim of the project is to carry out theoretical and experimental investigations to assess the fatigue behaviour of steel offshore

structures and to formulate guidelines for fatigue design. During the year under report, experimental investigations on the corrosion fatigue behaviour of welded steel tubular joints of offshore structures were continued. In all 11 corrosion fatigue tests have been conducted under this project: six on stiffened T joints, three on stiffened Y joints and one each on unstiffened T and Y joints. These joints were tested under constant amplitude axial loading of the brace at a frequency of 0.2 Hz in synthetic sea water environment. The sea water was prepared as per ASTM D-1141 specifications. With extensive instrumentation around weldments, crack initiation and crack growth around the weldment could be monitored from which the crack initiation life and the crack propagation life for the joints were obtained. The fatigue lives of these joints were compared with the fatigue lives obtained by using various codes of practice. An equation was proposed for obtaining crack initiation life of tubular joints under corrosion fatigue, which would be useful in fatigue life estimation using fracture mechanics. The fatigue life of the tubular joints under corrosive environment was found to be nearly half the fatigue life in air.

A computer software package was developed for fatigue analysis of steel offshore jacket towers and various modules have been validated with numerical examples. The software has the capability to predict fatigue life using closed-form expressions. A special feature of the software is its capacity for early prediction of fatigue life using deterministic approach at the initial stage of the design itself. Fatigue damage resulting from a



Fatigue test on a leaf spring of heavy duty dumper

single sea state, long term sea state, or during the service life of the structure can be predicted. Dynamic effects may also be taken into account by considering a dynamic load factor. For a detailed fatigue analysis, spectral approach has been adopted. The program can account for both wave and current effects. In all the cases of fatigue analyses, cumulative fatigue damage is evaluated using the well known Palmgren-Miner rule. S-N curves specified by API and other codal agencies have been used in the program. The project has been completed.

Wind Effects on Structures

During the year under report, the fabrication and erection of a prototype wind tunnel structure has been completed. A platform for gaining access to the test section for setting up models in the wind tunnel and a flexible coupling between fan and motor assembly and the wind tunnel structure have been designed and fabricated. The fan and motor drive system is being installed. Most of the equipment required for wind tunnel experiments such as hot-wire anemometry system, turn-table and traverse mechanism have been procured.

Modifications were carried out in the model wind tunnel between the fan and the settling chamber to improve the flow characteristics. A wooden model of the standard Aylesbury experimental building was tested for pressure distribution in the tunnel. Wind pressures were measured using scan valve over 58 ports. Experiments were conducted on simulation of partial boundary layer which is required for studies on low-rise buildings. A unidirectional force balance was designed, fabricated and calibrated for base moment measurements on models.

Data on wind speed, pressure and acceleration at different levels



Strain and deflection measurement of the spherical disc of a butterfly valve

on the 101 m tall microwave tower were collected at regular intervals. Using a software developed for the purpose, a number of wind speed records were analysed for wind and terrain characteristics. Wind spectral plots were also obtained from the data, and compared with standard wind velocity spectra given in literature. Turbulent length scales at various heights were calculated. Another software for analysis of random wind data was implemented. The foundation for a 55.1 m tall narrow base tower is under construction behind the Wind Engineering Laboratory. The tower will be instrumented for measurement of wind data. The proposed instrumentation system was finalised.

Studies on cyclone damage to wind sensitive structures such as poles and tall skeletal steel towers used in power transmission and communication systems were conducted. A post-disaster survey of the damage to buildings and structures due to a cyclone that crossed near Karaikkal (December 1993) was undertaken.

Elevated water tanks supported on circular shaft have been observed as dynamically sensitive to wind loading. The failure of one such water tank was analysed using codal provisions of IS:875 (Part-3) 1987, and also by the spectral method. The effects of soil-structure interaction and cracking were considered.

Minimum dimensional requirements for lighting poles of different geometries and materials of constructions, as well as minimum foundation dimensions, have been derived to reduce amplitude of vibrations due to wind-induced oscillations. Uniform and tapered cross sections have been analysed including the lumped mass of the lighting fixtures on top of the mast.

Studies were made on the gust response factor of tall chimneys. Over a hundred chimneys having various base width, base thickness, top thickness, thickness of lining, height and taper were analysed using the provisions of IS:875-Part 3 for gust response factor. A simplified expression for gust



Experimental investigation of an axle housing under cyclic load

ties and the end results have been compiled in the form of a final completion report.

Corrosion in Concrete Structures

Started in September 1993, in this new project for a development of methodologies for evaluating strength and residual life of corrosion affected reinforced concrete structures, a literature survey was made on the various service life models. In general, service life model consists of two typical periods, namely, 'initiation period' and 'propagation period'. The initiation period is influenced by the concrete cover thickness and the permeability characteristics of concrete with regard to oxygen. A detailed study of this model was made and data on methods of estimation of initiation period were collected. In the propagation period, it was found that actual measurement of 'corrosion rate' assumes importance in order to predict the residual life of a structural member affected by corrosion of reinforcement. Further, it is necessary to identify a suitable limit state at which the structure is to be declared unserviceable or beyond repair. In this respect, the recommendations given in CEB/FIP report were studied and it was found that a structural member is assumed to have reached its service life if the section loss in the reinforcement at critical section is about 25 %. This model assumes that the rate of corrosion is uniform throughout the period, whereas actually the rate varies with the environmental conditions, especially with the relative humidity.

A literature survey made on the available methods and techniques of measuring corrosion current revealed that the Linear Polarisation Resistance method is simple and yields reasonably accurate results. A few limitations of this method

response factor was derived based on non-dimensional parameters.

Corrosion of Reinforcements

In the studies on behaviour of corrosion-affected reinforced concrete components, laboratory experiments on beams with different degrees of corrosion-cracking were carried out. The objective of this experiment was primarily to identify a definition of the structural situation due to corrosion wherein no further distress can be accepted. As inducing corrosion damage is a time-dependent phenomenon, a few limited beams were tested in flexure and the experimental results have been analysed.

As a contribution to formulate guidelines for determining required cover thickness in concrete members to delay cracking due to corrosion, extensive experiments were carried out on concrete specimens with different compressive strengths, diameters of bars, and cover thicknesses. The results obtained have been compiled and graphs were established, relating (a) Cover to bar diameter ratio and

percentage weight loss at the time of cracking, (b) Cover thickness and weight loss per unit length at cracking for different diameters of bars.

These graphs can serve as guidelines in selecting appropriate cover thickness for a given diameter of bar which may help in delaying the cracking. In other words, it gives a refinement to the existing practice of arbitrarily adopting the same cover thickness for all diameters of bars.

In addition to the contemplated objectives, experiments were also conducted for evaluating a few concrete repair materials. These are essentially coatings and bonding materials used for concrete. The coatings were evaluated with regard to properties such as air-, water-, and chloride ion-permeability, adhesive strength with concrete surface, and protection to steel in delaying the corrosion. The bonding materials were evaluated for their bond strength between steel and concrete and concrete and concrete, flexural and compressive strength, etc. The activi-

have been identified and the proposed experiments will be oriented towards overcoming these limitations. About 30 cylindrical specimens and 30 prismatic specimens with varying cover thicknesses have been cast and are being subjected to chloride ion penetration by immersion in salt solution. After reaching the initiation period, these specimens will be monitored by measuring the corrosion current using the Linear Polarisation Resistance technique.

Six beam specimens are currently subjected to accelerated corrosion to study the behaviour under different levels of corrosion damage. This will be continued until the desired level of visual cracking is reached after which the beams will be subjected to tests under flexure. For studies on columns damaged due to corrosion, specimens are being cast for inducing accelerated corrosion.

Preliminary arrangements have been made to study the effect of corrosion on bonding by using the standard pull out tests. Fabrication of special moulds and preparation of reinforcing bars are currently in progress. Further, a simple galvanostatic test setup has been made in the laboratory for inducing controlled corrosion on these pull out specimens.

Strengthening Distressed Concrete Structures

During the year under report studies on hysteretic behaviour of RCC beams with externally bonded reinforcements were undertaken. Slow cyclic load tests were conducted on RC beams externally bonded with mild steel, FRP, and HRFC laminates. The test results showed that beams with externally bonded plates/laminates could successfully withstand slow cyclic loads.

Durability studies were undertaken on plated-beams by subjecting them to salt water corrosion. While FRP- and HRFC-plated beams withstood the attack successfully showing no signs of degradation in strength, steel-plated beams showed signs of corrosion, emphasizing the need for some protective treatment. The analysis of the results of tests carried out during the previous year were completed and technical reports incorporating design recommendations were brought out.

Different types of concrete protective systems were evaluated for their effectiveness in arresting/preventing corrosion of steel embedded in salt laden concrete. Polymer impregnation of 5 mm depth near the concrete surface and polymer concrete overlay of 5 mm thick were found to offer full protection to the embedded steel against corrosion attack. Surface coating with polymeric resins such as epoxy, polyester, and IPN performed satisfactorily as long as the coating remained in perfect condition without any gaps in the film formed on the concrete surface. The project has been completed.

Industrial Buildings Subjected to Wind Loads

Efforts were made to evolve a simple, practical and rational method for predicting the sequence of damage of a typical pitched roof steel industrial structure when subjected to extreme wind speeds, considering both wind loads and resistances of members as random variables.

A typical pitched roof steel industrial structure subjected to a basic wind speed of 50 m/s was designed using relevant IS codes of practice. Reliability indices of individual components (viz., roofing sheet, purlin, beam column joint, beam column, and foundation) and the frame as a system were deter-

mined using FOSM method. These reliability indices arranged in an ascending order give an idea of the sequence of damage that the structure is likely to suffer when subjected to wind speeds of 50 m/s. A parametric study was carried out to examine the effect of changes in coefficient of variation of loads and resistance on (probabilistic) damage to the structure. The results of this study were found to corroborate with the sequence of damages observed (on similar structures) during cyclones. Thus, the methodology developed can be used in the probabilistic damage analysis of industrial structures and also for vulnerability analysis.

A prototype knowledge-based expert system has been developed

Important SERC products & processes

- High strength deformed bar for concrete reinforcement.
- A process for making prestressed concrete poles using HSD bars and portable stressing beds.
- Small capacity ferrocement water tanks.
- Prestressed concrete monoblock railway sleepers.
- A process for manufacture of latoblocks (building blocks from lateritic soils)
- Fibre reinforced concrete - light, medium, and heavy duty manhole covers.
- Ferrocement service core units.
- Techniques for repair of cracks in concrete by polymer injection.
- Polymer impregnated concrete products - tiles, pipes, panels, etc.
- Polymer overlays for industrial floor, deck slabs and pavements. □

for damage assessment and vulnerability analysis of low rise pitched roof steel industrial structures using the knowledge bases developed earlier. An inference mechanism based on fuzzy sets is used for this purpose. Other features incorporated in the expert system include utilities to make it user-friendly.

Stochastic modelling of cyclonic winds and reliability analysis of structural frame work reported earlier have been suitably incorporated in the knowledge base of the system. The expert system is being validated by making use of data collected earlier by conducting survey of damage suffered by structures due to cyclones.

A neural network model for structural damage assessment has been developed. The input-output pairs required for training the network were obtained from cyclone damage survey reports. For fixing the architecture of the neural network, a methodology was developed. In this methodology, another Artificial Neural Network (ANN), called the meta-ANN, was used to encapsulate the performance of the given ANN. Using the architecture so obtained, a practical problem of damage assessment of structure against cyclones has been solved and reported in a paper.

Computer Aided Prestressed Concrete Grid Systems

Three preprocessor routines of the grid system have been developed for the automatic generation of (i) nodal coordinates, member connectivity and graphical layout, (ii) member properties and (iii) critical nodal forces covering class AA tracked- as well as wheeled-vehicles, and class A trains, with the built-in facility to arbitrarily increase their movement along the grid system. These routines have been linked together with the main grid analysis pro-

gram to form an integrated package.

An interactive subroutine has been developed that matches the critical section cable locations with those at end block section, and then brings out the profile of each corresponding cable by assuming parabolic profile in elevation or plan or in both elevation and plan, giving the cable coordinates in elevation as well as in plan at L/10, 2L/10, 3L/10, 4L/10 and 5L/10 from beam ends.

For keeping the cables within the concrete section throughout the length of the beam, without violating the specified detailing provisions, an interactive routine that widens the web and/or bottom flange or increases the bottom flange depth and widens the web or changes all the three together has been developed. For designing the shear reinforcement of post-tensioned concrete girders in accordance with any of the codal provisions of the three Codes of Practices, viz., IS:1343-1980, IRC:18-1985 and IRS-1986, an interactive sub-program has been developed.

For the calculations of losses of prestress in accordance with the provisions of any one of the Indian Codes of Practices (IS:1343-1980, IRC:18-1985 and IRS-1986; Concrete Bridge Code) an interactive routine has been developed.

An efficient algorithm for the selection and design of sections for simply supported prestressed concrete composite members with prestressing force applied in stages (upto two stages) has been developed. This algorithm effectively adopts the state-of-the-art methodologies on direct as well as iterative procedures that are currently being used in one form or the other in conventional composite prestressed concrete designs.

Steel Fibre Reinforced Concrete Composites

In continuation of the studies of structural behaviour of Steel Fibre Reinforced Concrete (SFRC) under flexural fatigue, more SFRC beam specimens were cast adopting different volume fractions. Flexural fatigue tests were performed on 40 SFRC test beams. These test results were considered for analysis. S-N curves and stiffness degradation curves have been obtained. The test results indicate that incorporation of fibre improves the static and fatigue load capacity of RC beams and results in reduction of deflections.

Using the impact test device proposed by Schrader and as per the ACI Committee Report 544, impact tests on all the specimens of size 150 mm diameter and 62.5 mm thick were completed. From these tests, it was observed that plain concrete develops most of its impact resistance within seven days of water curing, and incorporation of fibres leads to substantial improvement of the order of 200-600 % in impact resistance, depending upon the age of concrete and fibre type and content. Testing of SFRC specimens under direct tension, compression and flexure has been completed. From these tests, modulus of elasticity was determined.

To study the fracture characteristics of SFRC, notched beam specimens with varying fibre content and two different sizes were cast. Four different notch-depths were selected. A special device similar to conventional clip gauge was fabricated for measuring the crack mouth opening displacement. Test will be conducted on these specimens to arrive at the fracture parameter such as critical stress intensity factor (K_{Ic}) and the critical crack tip opening displacement (CTOD).

Sponsored Research at SERC

Corrosion fatigue of offshore structures: This project has been sponsored by the Institute of Engineering and Ocean Technology (ONGC). The objective of the project is to study the corrosion fatigue behaviour around weldments of stiffened steel tubular T and Y nodes of offshore jacket structures subjected to sea water environment under constant amplitude loading and random loading.

During the year under report, the experimental investigations scheduled under this project have been completed, except for the random load corrosion fatigue test on a T node, which is in progress.

Based on the static tests, stress concentration factor (SCF) was determined for the different nodes. The corrosion fatigue tests were conducted in synthetic sea water environment as per ASTM-D-1141 specifications. The sea water was continuously circulated to maintain the level of dissolved oxygen. The constant amplitude corrosion fatigue tests were conducted at different stress ranges and at a frequency of 0.2 Hz. Corrosion fatigue lives have been determined for the various nodes and compared with standard design curves. Crack growth data have been collected by using a crack microgauge. These data are helpful in developing a model for fatigue life prediction.

Performance of corrosion resistant bars: Sponsored by Tata Iron & Steel Company Ltd, the primary objective of this project is to evaluate the performance of the TMT-50 bars in resisting corrosion and delaying the consequent damage to reinforced concrete members.

During the year under report experimental investigations were continued on the conventional reinforced bars and the newly developed corrosion resistant steel bars, using electrochemical laboratory methods, laboratory exposure studies, and field exposure studies.

The laboratory electrochemical studies have been completed and the results obtained from potentiostatic and galvanostatic tests have been communicated to the sponsors. The laboratory electrochemical studies using polarisation methods indicate that the corrosion resistant steel bars are less sensitive to corrosion. It is predicted that the corrosion resistant property of the CRS bars may lie between 1.4 and 2.0 times over the ordinary steel bars of same grade and quality. Presently field exposure studies are underway.

ASTRA VMX and XLS frames:

The project has been sponsored by TVS-Suzuki Ltd. The ASTRA-VMX frame is basically a circular tube profiled in the shape of a moped chassis. In the mathematical modelling, the frame is considered as consisting of three-dimensional beam elements. The springs have been idealised as beam elements having equivalent axial stiffness with suitable end conditions. The static loads on the frame are primarily due to the self-weight, the dead load from various fittings, the fuel tank and the passenger load. The static analysis was carried out to find the structural response under these forces.

A free vibration analysis was carried out to find out the natural frequencies and mode shapes. As the dynamic response due to en-

gine induced vibration was of interest, frequencies in the range of those of engine vibration were identified. A time history analysis to find the response of the structure due to engine induced vibrations at various engine speeds (20 to 120 Hz) was carried out by applying a harmonic unit force at the nodes where the engine is mounted. The normalised displacements and accelerations at the nodes of interest were plotted. A similar analysis was carried out for XLS frames. Suggestions or measures towards enhancing performance during vehicle endurance test were provided.

Software for ship structures:

This project is sponsored by the Hindustan Shipyard Limited, Visakhapatnam, and aims at developing interactive and user-friendly software for analysis and design of ships and ship structures (CODES-1).

As the first task towards development of CODES-I software, appropriate changes in the I/O statement of 'CODES' have been made in order to implement the software on Unix platform. Software development work for the main menu of CODES-I using OSF/MOTIF tool kit of the X-window system has been completed. A widget tree describing the hierarchical structure of the sub-menus under the main menu has been formulated. This is necessary for efficient/error-free coding of the software. The main menu consists of facilities to select a ship design/ship structure design module, edit the data for the selected module and run the module. □



Instrumentation of a moped frame for measuring strain due to passenger load

Dynamic Pile-soil Interaction

The aim of this project is to study the effects of dynamic interaction of piles in a group with the surrounding soil under different kinds of excitation applied at the pile head. Development of computer software for the analysis of typical groups of machine foundations is also envisaged under this project.

During the year under report, wave propagation tests and resonant block tests have been conducted on the soil inside the SERC campus for obtaining the shear wave velocity and coefficients of elastic uniform compression/shear respectively of the surface soil. Efforts are under way to obtain the dynamic properties of subsoil layers using the crosshole equipment setup.

An elastic half space simulator (EHSS) facility has been planned, designed and constructed inside the structural dynamics laboratory. This facility conducts controlled dynamic tests on model test piles and pile groups under applied vertical and horizontal excitation at the pile head. The facility uses sand as the soil medium and 20 mm (outer diameter) steel pipes as piles with

different spacings and flexibilities. The dynamic properties of sand fill medium inside this facility are being evaluated using the surface wave propagation and crosshole techniques. Other test arrangements are being fabricated.

Simultaneously, the analytical work dealing with the evaluation of stiffness and damping of pile groups has been taken up during the year. A computer program PGSTIFF has been developed using Novak's model for pile groups under vertically applied dynamic loads. Illustrative examples have been worked out using the program and efforts are being made to improve this model. The analytical work will be continued further for other modes of vibration. This program, once developed, is expected to serve as a general purpose software to analyse the entire pile foundation substructure considering dynamic pile-soil-pile interaction. This can be used as a complementary program to the software DYNAL already developed for the general dynamic analysis of block foundations resting on any subsoil.

Steel Plated Grillages

Efficient procedures have been developed for dynamic analysis of plated grillages subjected to engine-induced excitations or suddenly applied dynamic loading. The QL9S2 model for static, vibration and dynamic analysis of stiffened plates/shells with arbitrarily located eccentric stiffeners has been integrated with the analysis module (ERRANA). A simple model (QL90M) based on

orthotropic formulation has also been integrated. Four mass lumping schemes namely: (i) Equal lumping, (ii) Proportional lumping, (iii) Consistent diagonal lumping, and (iv) Consistent Mass Matrix using Lobatto points have been developed. Subspace iteration technique based on profile solver has been used to extract eigenvalues. Convergence studies on vibration analysis of plates and stiffened plates with different boundary conditions have been conducted. 4-noded (QUAD4) and 9-noded (QL9 and MQL9) elements for plates and QL9S2 model for stiffened plates have been employed in the studies. As it is important to consider higher modes of vibration for engine-induced excitations, first fifteen frequencies have been extracted by employing different mesh configurations. The frequencies obtained in the present study using MQL9 element for plates and QL9S2 element for stiffened plates are found to be in good agreement with the closed form solutions and experimental values presented in the literature.

The module on mode dependent error estimator for vibration problems has been integrated with ERRANA program. The mode dependent error estimators and error indicators are found to exhibit monotonic convergence for vibration analysis of plates. An efficient adaptive refinement strategy based on elemental modal errors with suitable transformation matrices for stiffness and mass has been developed and implemented. The proposed strategy is more efficient than the method based on equal distribution of errors as it requires lesser number of elements to be refined.

Work on the development of knowledge-based software for design of local steel plated grillages has been continued. Based on literature survey, DnV rules for the

design of offshore platform decks have been chosen for the development of knowledge base. The rules corresponding to the design of plate, stiffener and girder were compiled separately and independent knowledge bases were developed from them. Additional design guidelines available in literature were also included into the knowledge bases. A database of required design coefficients has been developed and linked with the knowledge bases. The knowledge bases have been developed for the design of grillage for uniformly distributed static equivalent loads and using VP EXPERT shell. The grillage has been considered as simply supported. To help internal stresses in the plates for design, a simple method based on idealising the grillage as an equivalent orthotropic plate was chosen. A program module based on this method has been developed in 'C' and validated. The program has been integrated with the knowledge bases developed for design of offshore deck grillages. A database of standard T-sections available in Steel Tables of Indian Standards was developed and integrated with the knowledge base.

From a survey of the problems/failures reported with engine room grillages, it was noted that failure were mainly at connections between the engine and supporting structure. Hence it has been decided to conduct local analysis of grillages for dynamic loads.

Structures subjected to Shock Loadings

Extensive survey of available literature on acoustic and impact loads on structures was carried out. The shock loads taken up for investigation are those due to blast, impact and acoustic pressure. These loads are time-dependent, and the structural response involves large deformations, high strain rates and material non-linearities.

The problem of acoustic pressure loading on structures has

been studied in detail. With a view to understand this problem and to collect the recorded acoustic pressure data visits were made to SHAR Centre, Thiruvanthapuram. Some data of acoustic pressure time-histories have been collected. These pressures were recorded during the lift-off of SLV3 and ASLV rockets. These discussions have helped to understand the nature of the problem of acoustic loadings on surrounding structures. These acoustic loads can cause vibrations on the structures situated on ground, close to the launch pad. A state-of-art report on acoustic loading on structures has been prepared. Statistical and spectral analyses of the acoustic pressure data have been carried out and the resulting time-histories and spectra have been graphically recorded.

The research work on impact analysis of structures has been initiated with a review of the latest available literature. With the objective of verifying the computational methods to be developed, a few impact experiments are proposed to be carried out on unstiffened and stiffened steel panels. Two test specimens were prepared suitable to the available impact test setup, one with stiffeners and the other unstiffened, to study the relative merit of stiffening. Preliminary computations of natural frequencies and mode shapes of these plates have been made. The linear responses to the anticipated impact load have also been determined.

Elastic and Elastoplastic problems

Literature survey on the experimental techniques for elastoplastic problems, boundary element method and image processing technique has been carried out and a state-of-the-art report was prepared. The different experimental techniques for elastoplastic analysis such as strain gages, photoelastically, birefringent coating, etc., were applied to ascertain their suitability. Post-yield strain gages were used to measure the strain in uniaxial steel tension specimen with a central circular hole. Birefringent coating was applied on a beam specimen with a circular hole and the photoelastic fringe patterns around the hole were captured. Polycarbonate material which exhibits strain hardening properties similar to metals like



Fatigue test on a thermo-mechanically treated reinforcement bar

steel and aluminium was procured for photoplastic studies. Low modulus materials with high optical sensitivity, suitable for birefringent coating technique were also procured. Preliminary experiments on these materials are being carried out to assess their suitability for elasto-plastic stress analysis.

Towards the development of hybrid method using boundary element technique, a computer program was developed to solve two-dimensional elasticity problem which was tested on a problem of a circular cavity under internal pressure in an infinite medium.

R.C. Panels and Shells of Revolution

The project was started during the year under report. Literature survey was carried out to select suitable material models, finite element models and solution algorithms. This survey indicated that a realistic assessment of nonlinear dynamic response of RC structures subjected to extreme loads (seismic load) is possible by using hysteresis models for reinforced concrete and taking into account progressive degradation in strength and strain rate sensitivity of concrete under cyclic loads. It was further noted that case studies of RC shells such as containment vessels, cooling towers and large shell roofs subjected to seismic loadings are limited.

A computer program for nonlinear dynamic analysis of RC shell structure is being developed. Dynamic analysis is carried out applying Newmark's implicit direct integration technique. The average acceleration method is an extension of linear acceleration technique and is unconditionally stable. In the nonlinear dynamic equilibrium equations, the mass is represented by lumped mass and

damping is represented by Raleigh damping.

The concrete material in compression is being modelled using elasto viscoplastic constitutive law which takes into account compression softening. To account for dynamic behaviour, the strain rate sensitivity and progressive degradation of compressive strength are being included in the material model. The cracked concrete in tension is being modelled using smeared crack approach. Concrete in tension is being modelled as linear elastic behaviour of concrete in tension from tensile fracture. The tension stiffening effect is considered through the strain softening rule based on fracture energy release rate. The shear transfer mechanism of concrete at the cracked plane is being considered using a reduced value of shear modulus.

Space Grid Roof System

Started during the year under report, in this project extensive literature survey was carried out and a state-of-the-art report prepared covering single and double layer grids, connectors, and analysis and design of skeletal space frames.

Preliminary studies on large span roofs indicated material saving in space grid schemes when compared to conventional roofing schemes. For space grid schemes, designs with tubular sections were found to be more economical than those with angle sections. With these encouraging comparisons, codal provisions (IS:806-1978 and IS: 1161-1968) for design using hot rolled steel tubular sections have been studied.

A database on the properties of the circular tubular sections has been prepared arranging them in ascending order of weight for design purposes. The permissible

Degree in Footwear Technology

A vocational degree programme (MVS) in footwear technology was launched by the CLRI, Madras, in collaboration with the Birla Institute of Technology and Science, Pilani, in September 1994. It is an integrated degree programme. The training and instruction will be imparted by the BITS and CLRI. The degree programme has several unique features, viz., multiple entry and multiple exit facilities, credit accumulation system, built in diploma programmes, modular structure and practice school concept. The programme is sufficiently flexible for the personnel working in the industry to avail higher educational opportunities.

The programme was formally launched by Dr. M. Anandakrishnan, Vice-Chancellor of Anna University in September 1994. Prof. Venkateswaran, Director, BITS, Pilani, Shri Sahasranaman, National Project Manager, NLPD, and Dr. K V Raghavan, Director, CLRI, were present. Several leading industrialists attended the function. □

compressive stresses of various slenderness ratios and yield strengths, and permissible tensile stresses for different yield strengths have been curve fitted. A computer program has been developed for the design of the top, diagonal and bottom members of double layer flat space grids. The program also computes the total weight of steel tubes per unit area of the grid. Before developing an analysis program, computer storage minimization techniques for bandwidth reduction were studied, and a suitable technique has been implemented.

To facilitate automatic data generation with a preprocessor through graphics, AUTOCAD features have been studied for their adaptability in the preparation and transfer of data. From literature, inverted square based pyramid modules have been found to result in economical space grid structures. So, to start with, node, member and module drawings are being developed for pyramid modules using AUTOCAD features. A preprocessor program is also simultaneously being developed to convert the data from the drawing to a format suitable for the analysis.

Software for Aseismic Design

The project was started during the year under report. Work is in progress to identify and include improved models for nonlinear analysis of plane frames along with suitable modelling of substructure under seismic excitation. To provide interactive facilities, a graphic preprocessor has been developed. This will be extended to 3-D building frames. Necessary routines have been developed for the analysis of regular frames based on the seismic coefficient and base shear approach as per IS:1893-1984. Further developmental work based on the code oriented method is in progress.

As non-linear dynamic analysis of buildings involves considerable computational effort and high cost, attempts have been made to identify simple models which can be used to predict the dynamic seismic excitation. A detailed survey of available nonlinear material models has been carried out. Regarding the material, a simple model suggested by Liou and Kang (a simple stick model) has been studied along with the conventional model, under a given earthquake in the linear range. Both symmetric and asymmetric configurations have been considered. This simple model was found to predict the response well.

Parallel Processing for Dynamic Analysis

During the year under report an approach to implement the parallel algorithms for static finite element analysis employing multi-frontal techniques and parallel algorithms for finite element free-vibration analysis of structures on medium/fine grained machines like PARAM has been devised. The methodology is based on hierarchical decomposition. The advantage of this approach is a simplified and efficient communication routing.

The pseudo dynamic analysis code developed appears to be more effective on these multiple processor machines. Studies have been carried out with standard optimization problems to validate the design optimization and parallel sub-domain optimisation algorithms. A 630-bar transmission substation tower is taken as an example to study the efficiency of the parallel algorithms. The algorithm has been coded for optimization with non-linear response of the structure.

Structural Synthesis and Transmission Lines

Existing literature on the integrated response of transmission line towers was collected and reviewed to identify the method adopted for including the effects of cables and insulator and their behaviour when subjected to different combinations of loads. A report has been prepared to highlight the current status of understanding on the behaviour analysis and design of transmission lines. In modelling of integrated line system, wind and gravity loads were considered to act together. This aspect is different from what is available in literature. Modelling aspects of similar structural systems were considered and a stick-cable model was chosen in the first instance to model a two-

bay three tower system. Analysis of this system for both loads is under progress.

Knowledge-bases for optimisation of tower with respect to formulation and choice of strategies for choosing methodologies like stress ratio or linear programming technique are under development. Integration of wind load calculations with the existing tower analysis programs has been initiated. The integrated wind load calculation programs are being validated using the base on the existing tower designs.

Transmission Line Towers

A state-of-the-art report on 800 kV transmission line system has been prepared. The work carried out in Canada, U.S.A, Poland, Hungary and U.S.S.R. has been briefly reviewed, highlighting the various economical configurations of transmission towers adopted in these countries.

Basic layout of a 800 kV single circuit tower has been arrived at taking into account the insulator sizes, electrical clearances, and conductor type specified by Central Electricity Authority (CEA). The design loads have been calculated based on the draft Indian code (IS-802) and the recommendations made by 800 kV Working Group (No.6) of CEA.

A few configurations of self-supporting tower with different base sizes and bracing arrangements have been developed. Non-linear analysis of the tower is being studied using the software package TANDS developed at the center.

Two alternative configurations for guyed towers have also been developed. Further studies on the locations for guy anchors and the level of pretension in guys, taking into account assembly and erection aspects in addition to loading combinations, are in progress. □

Ornamental Plants — a Lucrative Industry

TODAY the cultivation and trade of ornamental plants have become a lucrative industry in many countries. The ornamental horticulture is therefore gaining considerable importance. To develop an aesthetic sense and to create an awareness among the people at large for making their homes and environment beautiful, healthy, green and colourful and also to generate self employment, the National Botanical Research Institute, Lucknow, has been organizing two major flower shows for the last 25 years. Chrysanthemum and Coleus show is held in December and Rose and Gladiolus show during January every year.

This year the Institute organized a two-day Rose and Gladiolus Show on January 21 and 22 at its Central Lawn. Enthusiasm among people is growing for this show, as evidenced by the large number of entries coming from different parts of the country numbering 1000 — 219 more entries than the last year's!

The floral arrangements put up at the show were highly attractive, with literary, filmi and appealing names such as *Kobe Catastrophe Gala Dress*, *Chandni Rat*, *Basant Panchmi*, *Homage to Gyani Zail Singh Bold and Beautiful*, *Roop Suhana Lagta Hai*, *Chand Purana Lagta Hai*, *Andaj Apna Apna*, *Unity in Diversity*, *Life is like a ladder climb it*, *Every dark cloud has a silver shining*, etc.

The Hindustan Aeronautics Ltd. (HAL), Lucknow, was the most successful exhibitor and lifted as many as six running challenge cups/shields/trophies. The best Red Rose of the show 'Charles Mallerin' was exhibited by Shri Uma Maheshwaran, HAL, Korba. The best bicoloured rose of the show 'Shiralee'; the best fragrant rose of the show 'Sugandha' and the best rose of the show 'Doris Tystermann' were exhibited by HAL, Lucknow; the best Indian bred H.T. Rose of the show was exhibited by Dr. M. Samim Ahmad, Lucknow; the best stripped/ streaked rose of

Computer Software Released

DR. S. Ramachandran, Chairman, CLRI Research Council, Madras, formally released the special software 'CIS-CON'. The software is for the assessment of consequences of chemical accidents. It assesses the damage potential of fires, explosions and toxic gas vapour releases from storage or process units. This software consisting of separate modules along with a database on properties of different flammables, explosives and toxic chemicals has been developed at the Cell for Industrial Safety and Risk Analysis Unit of the CLRI. It is a tool for engineers, safety analysts and managers for assessing the consequences of various modes of failures that can occur in an industrial environment. □

the show 'Anvil Sparks' was exhibited by Northern Railway, Varanasi, and the best Gladioli spike of the show was exhibited by the Superintendent, Raj Bhawan, Lucknow.

In a separate section the Institute also displayed its choicest collection of exotic and Indian bred roses, besides a large number of mutants evolved by it, such as, 'Tangerine Contempo', 'Yellow Contempo', 'Twinkle', 'Light Pink Prize', 'Mrinalini Lighter', 'Mrinalini Stripe' and 'Salmon Beauty Light'.

An eye-catching section of the show was that of gladioli where a large number of colourful varieties were on display. Of the 28 Gladiolus cultivars evolved by the Institute, most of them were on display, suitable for cultivation under sub-tropical conditions as prevalent in



A view of the floral arrangement at the Rose and Gladiolus show organized by NBRI, Lucknow

the Gangetic plains. About a decade ago gladiolus could be raised only in the hilly areas. But as a result of R & D endeavours of the Institute, these can now also be raised in the agro-climatic conditions of north Indian plains. A model layout plan for the commercial cultivation of gladiolus was also on display for the benefit of progressive growers with an estimated net income of Rs.80,000 per acre.

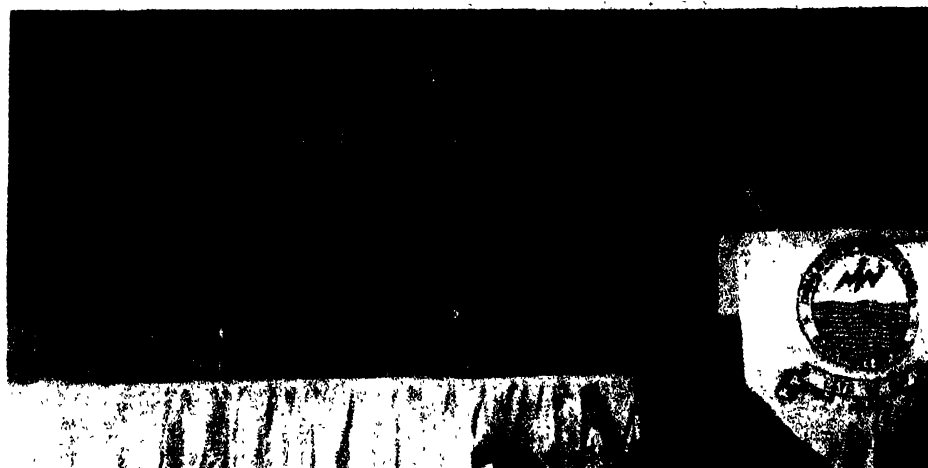
The prize distribution function attended by a large distinguished gathering was presided over by Lt. Gen. A.K. Gautam, G.O.C.-in-Chief, Central Command, Lucknow, and Smt. Lalitha Gautam gave away the prizes to the successful competitors. Dr. P.V. Sane, Director, NBRI, Lucknow, welcomed the Chief Guest and highlighted the R & D efforts of the Institute in evolving new varieties/cultivars of ornamental plants. So far the Institute has evolved more than 191 new cultivars of ornamental plants belonging to 15 genera, he said. He also spoke about the growing interest in the floriculture industry and its role in income and employment generation. Lt. Gen. Gautam appreciated the efforts of NBRI in this direction. Dr. M.R. Ahmad, Scientist & Head, Information Section, compered and conducted the function and Dr. S.C. Sharma, Head, Botanic Garden, proposed a vote of thanks. □

Workshops

Fly ash Utilization

A National workshop on Fly ash Utilization organized jointly by the Regional Research Laboratory (RRL), Bhopal, and Central Board of Irrigation and Power (CBIP) was held at RRL-Bhopal during 11- 12 January 1995.

Dr Ram Prasad, Director General, M.P. Council of Science and



Workshop on 'Fly ash Utilization' in progress at RRL, Bhopal

Technology (MPCST), Bhopal, inaugurated the workshop and Prof. T.C. Rao, Director, RRL-Bhopal, presided over the function.

Every year there is a turnover of nearly 60 million tonnes of fly ash, of which only 15% is utilized in India but in European countries the utilization is 60-80%. The state-of-art of ash collection, disposal and utilization in building materials sector and agriculture was discussed in the workshop. The topics covered in the workshop were: new applications for fly ash for various value added projects, advanced materials, paints and surface coatings.

Prof Rao distributed the certificates to the participants, Dr. A.H. Vegneswaran, Scientist, RRL-Bhopal, and Shri S. Ramakrishnan, Deputy Secretary, CBIP, New Delhi, coordinated the workshop and emphasized the need for more intensive exchange of information amongst R & D agencies, power sectors and user agencies. There were 30 technical papers and keynote addresses. More than 80 delegates including two from Electric Power Institute, Indonesia, and National Building Research Centre, Pretoria, South Africa, attended the workshop. □

Coal Seam with Cable Bolt Support

CMRI has developed a method of mechanized caving of thick coal seam with cable bolts as a support. It was put to experimental trial at NCPH colliery for mining 6-8 metre thick seam III.

The experiment was successfully completed in a panel with at least 25 per cent additional recovery of coal, with 15 per cent improvement in productivity, and over 5 per cent reduction in the production cost. The cable bolts ensured support of the roof irrespective of the working height and provided clear floor for efficient movement of the SDL and loading of the blasted coal.

Under the Indian coal mining regulations, the mining of coal seams over 4.8 m thickness was not permitted. As a result, all the seams within 6.8 m thickness were partially worked leaving coal in the roof or floor affecting conservation and inviting heat and fire. This method is likely to improve the level of extraction of coal from thick seams with improved safety, production and productivity. □



Workshop on 'Polymer Modified Binders for Road and Airfield construction' in progress at CRRI, New Delhi

Polymer Modified Binders for Roads and Airfields

TO build up close linkages with the industry and to promote and disseminate R&D findings, the Central Road Research Institute organized a workshop on Polymer Modified Binders (PMBs) for Road and Airfield Construction on 26 December 1994. In its first such arrangement with industry, the workshop was sponsored by National Organic Chemical Industries Ltd. (NOCIL), Bombay, and M.K. Petro Products, New Delhi. The workshop was attended by a galaxy of scientists, industrialists and road engineers.

Prof. D.V. Singh, Director of the Institute, while welcoming the delegates, highlighted the performance aspects of bituminous roads in India and specifically mentioned the role of bitumen in the present scenario. The escalating cost of bitumen and variation in its characteristics has been the topic of discussion among scientists and engineers.

Bitumen used in India is normally of 80/100 grade penetration. In extreme climate like -0°C and above 45°C , the performance of bitumen is not upto the mark. It has been increasingly felt that modified bitumen which can withstand low and high temperature stresses is most durable. Multi-grade bitumen, which fulfils the properties of modified bitumen, is available in the market.

The Central Road Research Institute has developed polymer modified bitumen to suit the requirements of low and high temperature regions and also for typical locations subjected to frequent acceleration and de-acceleration.

As a result of laboratory and field experiments, a technology for production of high performance polymer modified bitumen has been developed, patented and released to the industry. The workshop was arranged to further

disseminate and promote the use of polymer modified bitumen in road and airfield constructions. The discussions held during the workshop will usher in a new era for polymer modified bitumen.

Inaugurating the workshop, Shri K.K.Sarin, former Director-General (Road Development), Ministry of Surface Transport, stressed the need for developing suitable specifications that incorporate polymer modified bitumen for road constructions. Shri Sarin further said that if such specifications can become part of tenders, it would go a long way to promote the use of good material. Shri Sarin specifically mentioned that the high density corridors need high stability bitumen mixes which can be obtained by modified bitumen.

The workshop had three sessions : two technical sessions and one panel discussion. Among the important dignitaries and experts who contributed to these sessions included Dr. P.K.Mukhopadhyay, Retired Director, IOC R&D Centre, Faridabad, Shri D.K.Gupta, UP, PWD, Shri S.N.Mane, Addl. Director-General Border Roads, Dr. A.K. Gupta, Professor, Roorkee University, Shri A.R.Parasuraman, Managing Director, NOCIL, Bombay, Shri R.N.Jain, Director, M.K.Petro Products Ltd., New Delhi, and Shri I.R.Arya, Head, Flexible Pavements Division of CRRI.

The workshop recommended that more use of PMB be made in the construction of roads, its maintenance and overlay. The specifications for this product and its use in road mixes, design procedures and related aspects should also be evolved and submitted to the Bureau of Indian Standards (BIS) and Indian Roads Congress (IRC). □



Dr B.K.Sarkar, Director, CGCRI, at Lab to Man Exhibition held during Indian Science Congress at Calcutta

"Lab to Man" Exhibition

THE CSIR participated in a big way in the exhibition "Lab to Man" organized by the Indian Science Congress Association in collaboration with the National Council of Science Museums at Calcutta during 3-25 January '95 to mark the 82nd session of the Congress. Director, CGCRI, was the chief coordinator for CSIR. The exhibition was inaugurated by Shri Pranab Mukherjee, Minister of Commerce and Industry, and Shri K.V. Raghunath Reddy, the Governor of West Bengal, presided over the function.

In all, 27 laboratories of CSIR participated in the exhibition, viz., INSDOC, CSMCRI, SERC, NEERI, ITRC, CSIO, CBRI, CGCRI, CMERI, NIO, CCMB, CDRI, IICT, CMRI, CEERI, CFTRI, CLRI, IIP, RRL (Thiruvanthapuram), CBT, RRL(Bhubaneswar), CIMAP, CRRI, NAL, IICB, NML, and RRL (Bhopal). The wide range of products/processes developed by the CSIR caught the fancy of one and all—students, entrepreneurs, senior executives of private and Government departments, and scientists and professors who came for the

Congress. Housewives and journalists especially evinced keen interest in the CSIR technologies and other activities of the organisation. Models of aircraft *Hansa* and *Saras* of the NAL drew maximum attention of the visitors to the exhibition. So was the contraceptive pill 'Centchroman' developed by CDRI. There were several enquiries about the food technologies developed by CFTRI and the fish food developed by CCMB. Other products which commanded visitors' attention were wood substitutes, ceramic hip joint and cup, aromatic plants, instruments developed by CSIO, environmental technologies developed by NEERI, and building materials of CBRI. □

Foreign Visits

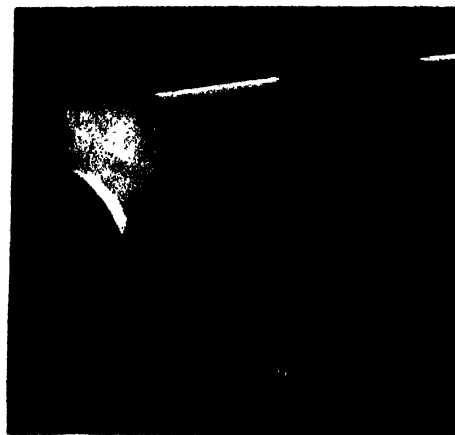
Chinese Team at NAL

A delegation of Chinese aeronautical scientists led by Dr Li Guangli, Director, Shenyang Aerodynamic Research Institute (SARI) visited the National Aerospace Laboratories, Bangalore, from 9th to 12th January 1995 to participate in the

first joint National Aerospace Laboratories-Chinese Aeronautical Establishment workshop on aerodynamics and propulsion. The workshop is a sequel to the official visits exchanged last year by the scientists of the same organisations. One of the highlights of the workshop was the time set aside for technical interactions. A video film on the wind tunnel facilities at the two countries was also shown. □

Chinese Delegation at CFRI

A high power Chinese delegation visited the CFRI at the instance of the Ministry of Coal, Government of India, at the end of 1994. Fan Weitang, Vice Minister of Coal Industry, People's Republic of China, led the Chinese team. The other members of the team were Zhou Dongzhou, Secretary, Ministry of Coal, Wang Cheng Long, Director, Department of International Cooperation, Ministry of Coal, Prof. Hu Shengsan, Senior Engineer and Deputy Director, Department of Science and Education, and Idu Gang, President, China N.C. ME Equipment Group. S.K. Sen, Director (Technical), BCCL, Dhanbad, and Dr. S.N. Koley, Chief General Manager (Planning), BCCL, accompanied the team.



A Chinese delegate being shown the research facilities at CFRI, Dhanbad

Mining Environment Congress

The Central Mining Research Institute, Dhanbad, will organise the First World Mining Environment Congress to be held during 11-14 December 1995 at New Delhi. The Congress is co-sponsored by the United Nations Sustainable Development and Environmental Management Branch, New York, U.S.A.

Environment, particularly in mining areas, is of great concern to one and all and demands special attention. A wealth of information and experiences is available in India as well as in other countries, and the time is ripe to collate and compile the mining environment experiences and bring experts on a common forum for an effective interaction, discussion and exchange of views. World Mining Environment Congress (WOMEC '95) will be of interest to the mining community of the world particularly to those who are responsible for planning, designing and operation of mining

and allied projects, and to academics and consultants, research workers, and government personnel responsible for implementation of policy and programmes in respective countries.

The theme of the congress is the 'State of Environmental Status of different countries' in terms of: (a) Environmental problems and issues, (b) Environmental management practices, (c) Environmental policy and legislation, (d) Socio-economic dimensions and its impacts, (e) Sustainable development vis-a-vis environmental management, and (f) future strategies - environmental training and environmental education.

All those engaged and interested on environment in general and mining environment in particular are eligible for participation in the congress. For more details, enquiries may be sent to : Prof Bharat B. Dhar, Director, CMRI, Barwa Road, Dhanbad-826001. □

Senior scientists of the CFRI led by P.K. Bandyopadhyay, Acting Director on that day, welcomed the visiting delegation and held useful discussions with the Chinese team after introducing the major activities and capabilities of the Institute in various areas of coal utilization. Assessment of the resource quality of coal, its conversion to coke, gas, domestic fuels (particularly briquetting), use of improvised domestic ovens (*chulha*), preparing coal for the industries by coal washing, etc., transportation and combustion of coal slurry, generation of thermal power and simultaneously utilizing the waste fly ash, recovering chemicals from coal tar and also processing coal to oil were the subjects

highlighted and their importance in the future energy planning scenario of India discussed. The Chinese dignitaries not only took keen interest in the CFRI activities but also appreciated the capabilities of the CFRI developed over the years. They pointed out some areas of coal utilization in which collaboration and exchange of scientific knowledge and information would be mutually useful to both countries. Chinese team expressed their interest in areas like fluid bed combustion of coal for power generation, including integrated gasification and combined cycle operation for power; desulphurisation of coal; coal preparation; briquet-

ting; coal water slurry; and coal liquefaction. □

Honours & Awards

Biman Basu

Shri Biman Basu, Scientist F and Editor, *Science Reporter*, Publications & Information Directorate, New Delhi, has received the National Award for Best S&T Coverage in the Mass Media for the year 1994. The award carries rupees fifty thousand in cash, a bronze medal and a scroll with a citation. Shri Basu shares the award with Dr. Hemant Laxman Vinze, a Bombay surgeon.

Shri Basu has been a prolific writer on a wide range of science and technology topics in English and Bengali written both for adults and children. He has written three books and over 400 articles. He has



Shri Biman Basu, Editor, *Science Reporter*, receiving the 1994 National Award for best S & T coverage in the mass media from Eduardo Faleiro, the Minister of State for Ocean Development, at a function in New Delhi

also been a science broadcaster of All India Radio since 1975. His talks and features are regularly broadcast on the national hook up. He has been closely involved in the conceptualization and execution of one of the biggest S&T communication projects of NCSTC and AIR *Manav Ka Vikas*. □

CSIR

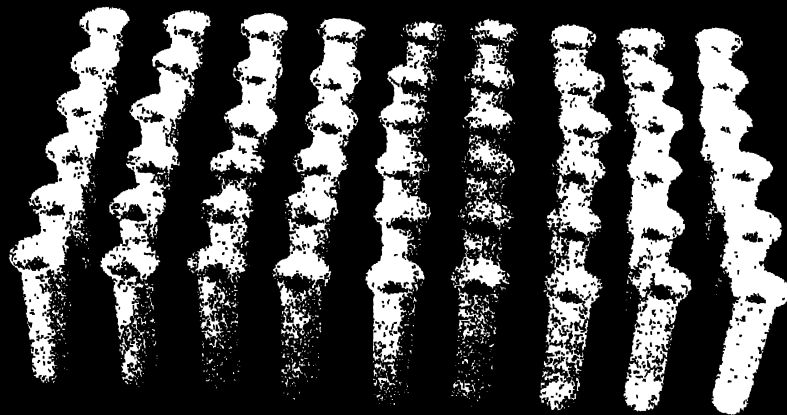
NEWS



VOL 45 NO 7 15 APRIL 1995

IN THIS ISSUE

Central Road Research Institute R&D Highlights: 1993-94	98
SOLAR '95 at CECRI	105
Medicinal Plants of India	106
Oil Conservation Week at IIP	108
NIO Foundation Day	109
NML-Galvasave knowhow	112
CGCRI-made ferrules installed in Mathura Refinery	112



A multi-lane submersible bridge across Gomti river designed under the technical guidance of the Central Road Research Institute, New Delhi (Top). Ceramic ferrules designed and developed at CGCRI Khurja Centre for Mathura Refinery Ltd (Bottom)

Central Road Research Institute, New Delhi

R&D Highlights: 1993-94

APART from the R & D work pursued during the year, the Institute has been actively engaged in transfer of technologies/knowhow by taking up consultancy assignments, organizing training programmes and harnessing other media to ensure wider application of CRRI research products. Efforts are also being made to mobilise resources for upscaling R & D work to enhance the marketability of R & D expertise of the institute and strengthen its competitiveness which will also ensure a greater role of the institute in roads and road transportation sector in the years to come. Given below are the important R & D highlights of the institute during the year.

Geotechnical Engineering

Jute-based Geotextiles for Civilian needs: Realising the use and potential of geotextiles in civil engineering structures, a study was

conducted in collaboration with Bombay Textile Association to evaluate the engineering properties of jute-based geotextiles consisting of a blend of varying proportions of jute and High Density Polypropylene for typical functions in civil engineering structures. Studies were carried out on different types of jute-based geotextiles for different functions like separation, filtration, reinforcement, etc. Besides showing promising results to improve permittivity and transmissivity characteristics, jute-based geotextiles show permanent deformation in the direction of load while synthetic fabrics do not show any residual plastic deformation.

Investigation of Landslides:

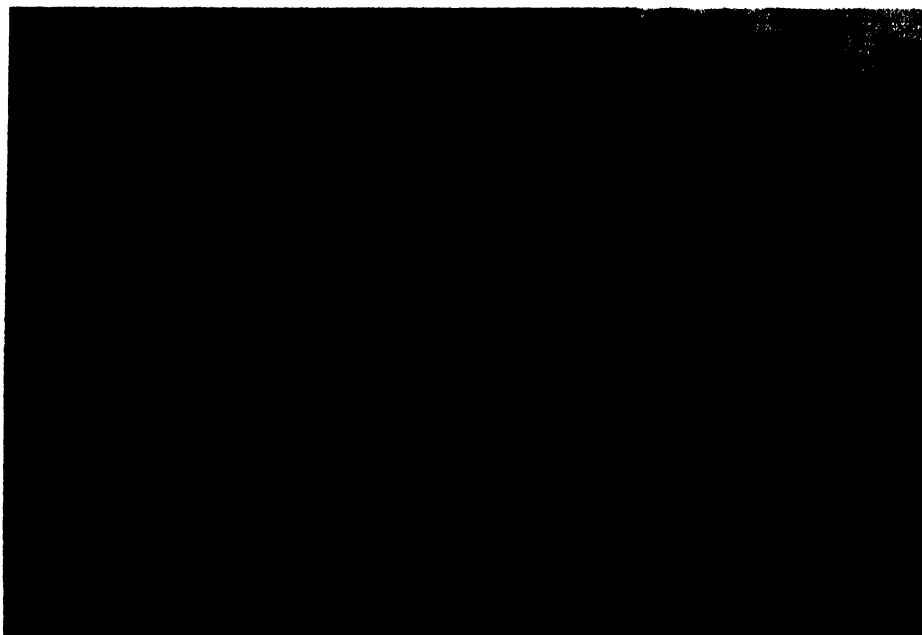
Under the project sponsored by the Department of Science & Technology (DST), a major landslide spot close to Powari in Himachal Pradesh was considered for the study. Analysis of slope stability by

Bishop's method indicates that the slopes at the Powari slide are in general almost stable and experience heavy rainfall. To understand the effect of rainfall on slope stability, a computer programme was developed.

Stabilization of Landslides:

In many cases, owing to the development of high pore water pressure in the soil rock media, landslide and failure of many earthen rock slopes take place. For preventing such occurrences, a study sponsored by the DST, was undertaken to develop suitable guidelines for designing any trench drainage system as a measure to lower the ground water table and therefore to achieve reduction of pore water pressure. In this study, the effects of different relevant soil parameters like permeability and the specific yield along with geometrical features of trench drainage are covered.

Asian Highway Network: A report was prepared on the status and condition of the Asian Highway Network in India for the consideration of ESCAP, UN. Asian Highway Network in India forms a part of the Asian land transport infrastructure. The network provides connection to main industrial and agriculture centres; to major sea and river ports for integrating land and sea transport network; and to major container terminals and depots for integration of rail and road networks. Such connections minimize the number of links to be included in the network and make the maximum possible use of the existing infrastructure.



Mastic asphalt surfacing

Soil Stabilization and Rural Roads

Rural Roads: A computer based model for planning of rural road network developed earlier has been used to prepare an optimized road network plan for Phagi and Kotputli Tehsils of Jaipur district in Rajasthan. With this model, an optimal road network plan using simple data from topographical sheets and census records has been prepared.

Municipal Wastes in Road Construction: Under this project sponsored by the Ministry of Environment & Forests, different samples of aerated municipal wastes and compost pebble waste (mixed samples) were collected from compost plant at Okhla to know their suitability for use in road subbase and embankments. Test results indicated that of all the samples, mixed samples were found to have higher density, higher CBR and better strength characteristics. They were also found to be quite uniform in their composition and strength characteristics and so quite usable for road construction.

Geotextile Filters for Pavement Edge Drains: To study the filtration characteristics of various geotextiles wrapped around a perforated pipe in edge drains and to choose the best filter system among the various alternatives, a laboratory study simulating the field conditions was carried out. Test results indicated that the soil fabric system is superior to the conventionally graded soil filter system. Among the various fabrics for filtration/drainage, the needle punched non-woven type is better than the plain woven geotextiles.

Kota Mine Waste in Road Construction: At the request of Rajasthan Public Works Department, studies were carried out on the utilization of Kota mine waste in road construction. The Kota

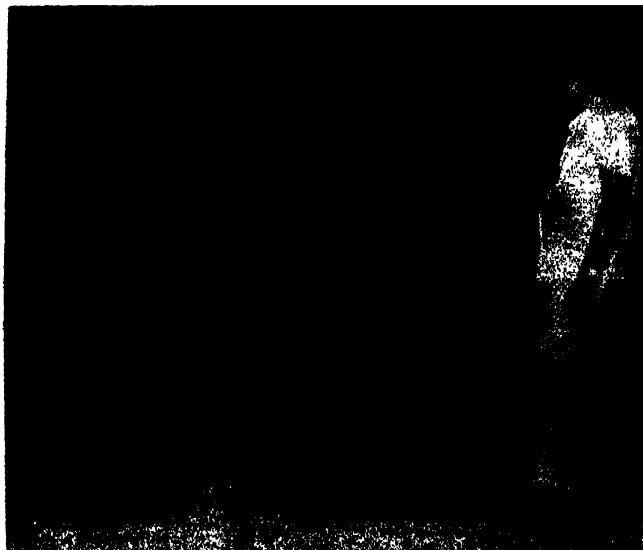
mine waste consists of overburden material, kota stone waste and limestone slurry. Studies on the use of Kota mine waste in highway embankment and as coarse aggregate indicated that this material can be sufficiently compacted for the construction of an embankment. Its use as coarse aggregate in WBM layer has also been found feasible. Lime slurry with 25 per cent of sand can be used as binding material in the construction of WBM.

Fly Ash as a Fill Material: A study was carried out on the utilization of pulverised fly ash, a waste product from thermal power stations as such, or after some modifications, as a fill material in low lying areas. Laboratory investigations indicated that ashes can be used as fill material.

Flexible Pavements

Complex Compounds as Anti-oxidants: Studies were carried out on the development of complex compounds as anti-oxidants. The adducts of metal diethyl dithiocarbamate with 8-hydroxyquinoline, pyridine, 2,2 bipyridyl and 1,10 penanthroline were synthesized and were characterized by elemental analysis, FTIR and UV-vis spectroscopy and thermal behaviour. It was observed that adduct of oxide with zinc is a more promising anti-oxidant in bitumen.

Collaborative Bitumen studies: In collaboration with Indian Oil Corporation, a study on the use of cationic bitumen emulsion in road construction under different cli-



Laying of RCC and plain cement concrete slabs under the loading frame of the heavy test bed area of the C.R.R.I.

matic conditions was carried out. Test sections with premix carpet and sand seal/liquid seal coat and semi-dense asphaltic concrete were laid in snow bound area (Battote, J & K), in high rainfall area (Silchar) and in desert area (Rajasthan). On performance evaluation,

C.R.R.I. Working Manual on Rural Roads

A working manual for the construction and maintenance of rural roads has been prepared for junior field staff. This manual contains details of construction of embankment subbase, base course and surfacings. Various techniques of construction, including the conventional ones for each layer have been dealt with in the manual in lucid language with the help of necessary illustrations. A short note describing the essentials of individual layer, various laboratory and field tests, and the construction procedure in steps, has been given. □

It was observed that premix carpet with liquid seal using bitumen emulsion performed better than test section of bitumen. Use of bitumen emulsions also reduces the reflective cracking in overlays.

C.R.R.I. Patents and Processes

PATENTS released so far to the industry by the C.R.R.I.:

- Bitumastic Jointing composition
- Improvement in or relating to pitch mastic composition
- A process for the treatment of styrene pitch
- Improvements in or relating to the manufacture of lime-surkhi
- Improvement in or relating to the manufacture of reactive surkhi
- Fatigue testing machine
- Unevenness indicator
- A profilograph for checking pavement unevenness
- Automatic road unevenness recorder
- Rotiller (developed jointly by MERADO and CRR I)
- Pavement paint marking machine (developed jointly by CMERI, Durgapur, and CRR I)
- Vehicle profile meter
- Polymer modified bitumen
- Improved bullock cart technology

All the patented and a few other processes of the institute are being exploited directly by the institute and also through the National Research Development Corporation of India, 20-22 Zamroodpur Community Centre, Kailash Colony Extension, New Delhi-110048. Industries interested in commercial exploitation of these processes may contact NRDC or CRR I. □

Cationic Bitumen Emulsion:

The commercial samples of cationic bitumen emulsion of RS, MS and SS type were evaluated for their physico-chemical properties as per IS-8887-1978 and they were found within the specified limits of BIS.

The performance evaluation of utility cut made with emulsion indicated that MS type of cationic bitumen emulsion gave durable top surface with coarser aggregate. The utility cut made with cold mix was found very good after four years. The cold mix can be used on city roads and highways with ease.

The small patches repaired with semi-dense asphaltic concrete and premix carpet alongwith sand seal coat also showed very good performance.

Mastic Asphalt Surfacing: To avoid the premature distress of surfacing at intersections, bus stops and for protection of bridges from corrosion, mastic asphalt has been recognised to provide better high strength and impervious surfacings. Economic considerations restrict the use of mastic asphalt only on bus stops, intersections, overbridges/flyovers. Mastic asphalt has been extensively used in Delhi on intersections and flyovers. Further studies on evaluation and design of mastic asphalt mixes are in progress.

ATV Prene Thermoplastic Elastomers : At the instance of M/s ATV Projects India Ltd, Bombay, a study was undertaken for evaluation of ATV Prene thermoplastic elastomers for bitumen modification for roads and airfields. Laboratory investigations indicated that the product is compatible with bitumen and modifies its properties. The modified bitumen can be used as stress-absorbing membrane for sealing of cracks, stress absorbing interlayer for pre-

vention of reflection cracks, as binder for mastic asphalt for bridge decks, etc. The bitumenous mixes with modified bitumen can also be used for airfield pavement surfacings.

Rigid Pavements

Roller Compacted Concrete Pavement: To improve riding quality of roller compacted concrete pavement, semi-field studies were carried out using modified concrete mix. Different RCC and plain cement concrete slabs were laid under the loading frame of the heavy test bed area of the institute. The load carrying capacity was found similar in both the PCC and RCC pavements. The strength and riding quality of the RCC surface was improved through better interlocking behaviour of the coarse aggregates.

Ferro-Manganese Slag in roads: Studies were carried out to explore the utilization of ferromanganese lumpy slag (a waste material of ferro-alloy industry) as concrete aggregate. Various physical properties of ferromanganese lumpy slag crushed to coarse aggregate were also studied.

Pull-out Test for Deformed Tie Bars: At the instance of Project Director, ADB Project Circle, PWD B&R Branch, Faridabad, pull out test was performed on tie bars 10 nos. embedded in concrete slab in NH-2 Rigid Pavement Construction, Ballabgarh-Mathura Section. An equipment that carried out the pull-out test on tie bars was designed and fabricated at the institute.

Software for Rigid pavements: Software programmes were developed for the design of rigid pavements and cement concrete mix based on IRC guidelines. Further work for their validation is in progress. Besides, a software on computer-aided evaluation of air-



Pullout test in progress

field and highway for evaluating rigid pavements and under influence of traffic, soil subgrade strength, and residual flexural strength has been developed.

Curing of Concrete: Studies were carried out to determine efficacy of two commercially available curing compounds in terms of flexural and compressive strength of concrete vis-a-vis conventional curing with water. Further work on physical and chemical characterization of curing compound and determination of abrasion resistance of liquid membrane forming compound is in progress.

Pavement Evaluation

Interlocking Concrete Block Pavement: Zojila complex road in J & K State runs through steep, zig-zag and mountainous terrain with maximum height reaching over 3500 m. This section remains snow bound and inaccessible to traffic for almost seven winter months of the year. Due to the inhospitable climatic conditions, formidable logistic problems and limited working period available for *in situ* construction, the construction of bitumenous pavement on the Zojila sector has not been pos-

sible. In collaboration with Border Roads Organisation, a study was carried out to construct a high-altitude experimental section in this sector by special application of Interlocking Concrete Block Pavement (ICBP) which is considered to be eminently suitable for such problematic sections. The test section was constructed for experimentation in three stretches by using: (i) *in situ* lean concrete base course and ICBs paved on coarse bedding sand in two paving patterns, and (ii) concrete base blocks paved on coarse bedding sand and ICBs paved on coarse bedding sand. Performance data for the experimental section is awaited.

Skid Resistance on Arterial Roads: For establishing correlations between skid numbers and the texture depths, a study on evaluation of skid resistance and texture depth of different arterial roads in Delhi has been carried out. Development of periodic data for evaluation of skid resistance of arterial roads in Delhi is in progress.

Material Characterization: Studies are being made on the structural evaluation of different layers of pavement materials to assess their mechanical properties at different

temperatures and the effect of temperature and frequencies on dynamic modulus of subgrade soil at different moisture contents. Based on the studies made on the laboratory prepared asphalt concrete specimens by using material testing systems, the dynamic modulus and the resilient moduli were determined at varying moisture contents and frequencies. It was found that the dynamic modulus increases with the increase in frequency and decreases with rise of temperature.

Structural Evaluation of some selected National Highways:

This project was sponsored by the Ministry of Surface Transport for the structural evaluation of certain selected sections of National Highways 2, 8, and 11. Falling Weight Deflectometer (FWD), Lacroix Deflectograph (LD) and Benkelman Beam (BB) were used to calibrate the equipment so as to make them usable under Indian conditions and to evolve a set of comprehensive guidelines for the use of these equipment for structural evaluation of the pavements, their expected remaining life, estimation of overlay requirements and establishment of correlations among these equipment. Pavement deflections were measured on the selected stretches of NH-2 and NH-8 by the use of FWD and BB. Subgrade soil samples were also collected from the representative sites of different NHs. Based on the laboratory evaluation of the subgrade soils and the analyses of the pavement deflection data, the overlay requirement and the remaining life of the pavements were obtained. Output in the form of E values for different structural layers, overlay requirements and the remaining life of the pavement was obtained. Deflection comparisons and the different correlations so developed, have also been included in the final report. Based on the studies, it is generally accepted

that FWD is the most suitable device for structural evaluation.

Road Systems for Tata Complex: At the instance of M/s Tata Chemicals & Fertilizers Ltd at Babrala, U.P., an investigation for pavement design of new roads and improvement of existing roads inside fertilizer plants complex was undertaken. Based on the field and laboratory investigations, recommendations were made on appropriate pavement design and construction specifications. The road network in the plant area was grouped in three categories such as existing roads, GAIL roads and new approach roads.

Skid Resistance measurements: At the instance of International Airport Authority of India, an assignment was undertaken for the determination of skid resistance of the main runway on IGI Airport, New Delhi, by the use of high speed devices. The objective of the study is to assess the adequacy of friction levels of the runway. For safe aircraft operation, skid resistance measurements were undertaken by a high speed device Mu Meter. Field observations on texture depth, roughness and longitudinal profiles were also recorded by using fifth wheel bump integrator and profilograph. Analyses of the data is in progress.

Axle Loads on National Highways: At the instance of M/s STUP Consultants, New Delhi, studies on spectrum of axle loads on NH-3 and NH-4 were undertaken, to determine the vehicle damaging factor for the commercial vehicles plying on the NH-3 sections (near Guna, M.P.) and NH-4 sections (near Belgaum, Bangalore). Recording of axle loads for the commercial vehicles plying on NH section was conducted with weighing platform and an electronic indicator unit. Vehicle damaging factors were determined for the NH-3 and NH-4

Instruments fabricated at C.R.R.I.

Roller Mounted Nuclear Density Gauge: To develop a non-destructive testing device which can measure density continuously just after the roller compaction of asphaltic concrete and soil base course, the institute has developed Roller Mounted Density Gauge. The prototype of the gauge has been fabricated and provided with a trolley for moving it on the compacted surface for getting density profile.

Road Geometrics Measuring System: The institute has developed a Vertical Profile Meter for on

board measurement of vertical gradient of roads. The distance measuring unit which is a part of the system has been specially designed to suit Ambassador car and Mahindra & Mahindra jeep. Units of this device were fabricated and supplied to IIT (Bombay) and RITES/GERI.

Software Development : For inventorisation of electronic components, instruments and facilities available, a programme has been developed. This package has been divided into three parts, i.e., Component Management, Instrument Management and Facility Management. □

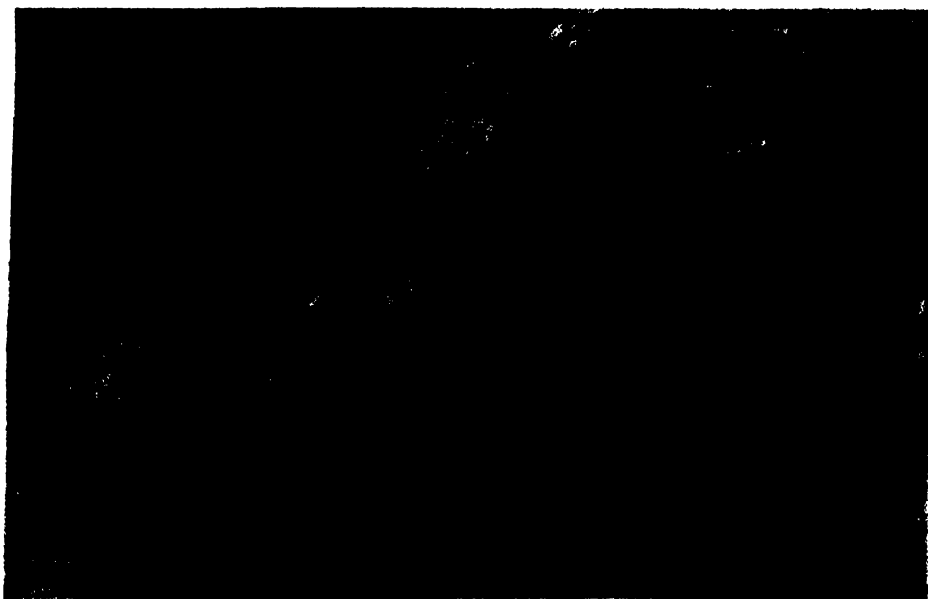
sections and the final report was submitted to the client.

Surface Profile of Concrete road: At the instance of Asian Development Bank, Faridabad, surface profiles were recorded at the identified locations of NH-2 near Ballabgarh, Faridabad, by using profilograph. The profiles were analysed for assessing the magnitude of irregularities more than 3 mm

amplitude and their occurrences on the newly laid cement concrete pavement sections on Delhi-Mathura road near Ballabgarh.

Bridges

Corrosion in Concrete Structures: Studies are being carried out to control the corrosion in RCC structures by applying protective



Investigations of a landslide in progress

Objectives of the C.R.R.I.

- To carry out basic and applied research, in line with the national priorities for investigation, design, construction and maintenance of different types of roads and runways, including related materials such as aggregates, bitumen, cement, etc.
- To carry out research on the utilisation of locally available materials for construction and maintenance of roads and runways economically.
- To carry out research on the performance of different types of roads under varying climatic and traffic conditions.
- To carry out research and development in all aspects of road traffic and transportation engineering, including the study of accidents, development of road safety measures, psychology of road users and transportation economics as related to different forms of transport.
- To develop specifications, labour intensive methods and manual aids for construction of low cost all weather village roads for underdeveloped regions of the country.
- To develop appropriate tools, machinery, equipment and instruments for adopting technologies related to highway engineering and relevant to the country to achieve self-sufficiency.
- To render technical advice and consultancy services to various organizations in roads and other related fields to avoid import of foreign expertise.
- To train road technologists through refresher courses, workshops and training programmes for wider application of indigenously grown technologies.
- To create and establish all the necessary infrastructure, both in equipment and expertise, in the various facets of highway and transportation engineering and allied subjects and as and where need be to obtain judicious solutions to special problems.
- To develop and assist other institutions or departments of the institutions for scientific study of problems concerning roads, road transportation and related practices in particular regions.
- Establishment of extension units, display centres, etc., to further the scope of scientific and technological research and development in the related fields and utilize the same for experimental studies.
- Demonstration and utilization of the results of the research conducted by the institute for the development of highway and highway transportation engineering in the country. □

coatings on steel reinforcements and by using inhibitors in concrete mix. Laboratory studies conducted on three different types of zinc rich coatings (zinc rich epoxypolyamide paint, zinc rich potassium and ethylsilicate) with a top coat of sodium nitrite inhibitor on steel reinforcement, indicated that zinc rich epoxypolyamide paint is effective only upto 225 cycles of immersion. The zinc rich ethylsilicate with a top coat of sodium nitrite inhibitor is effective only between 70 to 230 cycles.

Expert System for Truss Girder Bridges: The study has been taken up with the objective to develop Expert System software for structural optimisation of truss girder bridges under moving loads. A generalised method of optimum design for all the six types of trussed girder bridges, namely,

through type warren truss, deck type warren truss, sub-divided warren truss, parallel-chord pratt truss, curved chord pratt truss and K-type truss has been developed. This method is based on random search technique using selective active constraints.

Three Girder Skew Bridges: A computer program to determine free moment and net moment at various equi-spaced sections for each of the three girders of a skew bridge with three similar equally spaced girders has been developed. The analysis is based on the semi-continuum method.

Traffic & Transportation

Flow Data Base for Road System in Delhi: With a view to developing traffic and transport flow database for road system in Delhi urban area, temporal trends of traffic flow

on some selected arterials in Delhi and some stretches of outer ring road were analysed. The analysis was based on traffic flow database for 1989 and 1991. The overall average annual growth rate of traffic with variation on individual arterials ranges between 1.9 and 12.2 per cent. Traffic flow composition trends indicated that the overall proportion of buses, trucks, motorised two wheelers and other light fast vehicles decreased slightly while the proportion of cars and non-motorised vehicles increased during 1989-1991.

Traffic Simulation Model: To quantify the effects of ribbon development on the free speeds of vehicles on Indian highways, traffic data on classified volume count was collected and coded for different categories of vehicles.



I/O board for general purpose 8085 microprocessor circuit

Effect of kinds of intersections on the free speeds of different types of vehicle were also studied using radar. To determine the mean used power weight ratio distribution for different types of motor vehicles, data on spot speeds, journey time, difference in elevation, frontal area of vehicle and distance between points was collected and analysed for three sites having different roughness levels.

Further, field surveys were also carried out for recording the various traffic events on the selected road stretches for the purpose of calibration and validation of traffic simulation model being developed at IIT, Kanpur.

To study the effect of road width, surface roughness and horizontal curvature on free speeds, the data on free speeds of ten types of vehicles was recorded with radar speedometers at the selected sites in plain and rolling terrain in different states.

Telecommuting as an Effective TSM Technique: In view of the dominant role of automobiles and grossly imbalanced road infrastructure in urban India, the urban transportation policy needs reorientation in the country in favour of

moving 'work' rather than moving 'people', a trend known as 'telecommuting'. A review of introduction of telecommuting as an effective transportation system management technique was made to reduce commuting trips.

Transportation System for Surat:

To plan a transportation system for Surat Municipal area, four future transportation scenarios

were worked out for catering to the projected travel demand in Surat city in 2001 A.D. The proposed road network has been worked out to minimise the need for both widening the existing roads and construction of new areas and to seek the provision of new road links in the suburbs of SMC. The overall size of the proposed road system is estimated to be 1231 km in terms of traffic lane, of which 415 lane km (34 %) pertains to existing roads. A two phase programme has been prepared for the implementation of the road system.

Traffic Planning inside

TISCO: At the instance of Tata Iron and Steel Company, Jamshedpur, a study was carried out to assess the pattern, magnitude, safety and infrastructural requirement to improve the traffic operations on the road network inside the TISCO works and to plan for future road network requirements catering to the internal demand and interface with external links. Based on surveys, intersections were designed, road network requirements in terms of pedestrian, cycle tracks, road widening, strengthening of existing routes and other parking measures were suggested.

Road System for Aizwal: On behalf of PWD, Government of Mizoram, the institute prepared road network plan for Aizwal, the capital of Mizoram, to cater to the growing long term future traffic demand upto 2011 A.D. Three ropeway systems and various short term improvement proposals were recommended.

Environment and Road Traffic Safety

Efficacy of 'Raksha': During night time, glare caused by headlights of oncoming vehicles momentarily blinds drivers and is thus a main cause of road accidents. 'Raksha' is a device which automatically dips motor vehicle headlights reducing ill effects of glare. C.R.R.I evaluated functional efficacy of this device and found it to be quite efficient in dipping headlight beam.

Substitute for Road Marking

Paint: To develop formulation of retro-reflective thermoplastic materials suitable for road marking, the samples were prepared using the hydrocarbon resin, rosin, maleic resin as a binder along with vegetable oil, aggregate pigment and glass beads in varying proportions. The developed material fulfils the requirements of International standards and is more cost effective than the presently used road marking paint.

Traffic Noise Level in Delhi:

To assess the impact of noise in different residential density zones, the study revealed that the planned residential colonies even in higher density zone are less noisy than non-planned colonies. The noise level increases with increase of residential density upto 300 to 500 per hectare level. Beyond the above level, the impact of increase in density or noise level is not significant.

Pavement Management and Road Investment Policies

Pavement performance: Under the study on existing pavement sections, pavement deterioration models have been developed for Indian conditions based on periodic pavement performance data collected from existing road sections. Besides, a number of models were also developed for estimation of initiation stage and progression of different distress modes, separately for different pavement surfaces. These models form important inputs in Pavement Management System in deciding the maintenance and strategies for the upkeep of road networks in an optimal manner.

Under the study on New Pavement Sections, investigations were continued on NH-8 near Gurgaon for identifying more borrow areas for different types of soil. The construction of experimental section under Vadodara bypass is in progress.

Road System and Software

Pavement Management for India: Recognizing the need for a well planned, comprehensive and indepth study in the area of pavement management, Indian National Science Academy sponsored the preparation of an Approach Paper based on the proposals made by the institute. The Approach Paper draws upon the intensive interactions with the Indian highway professionals and experts through INSA-CRRI Panel discussions and a CRRI-INSA workshop convened under this project. A variety of new insights and imperatives have therefore emerged which deserve priority attention for ensuring the development of efficient, effective and economical Pavement Management Systems for India.

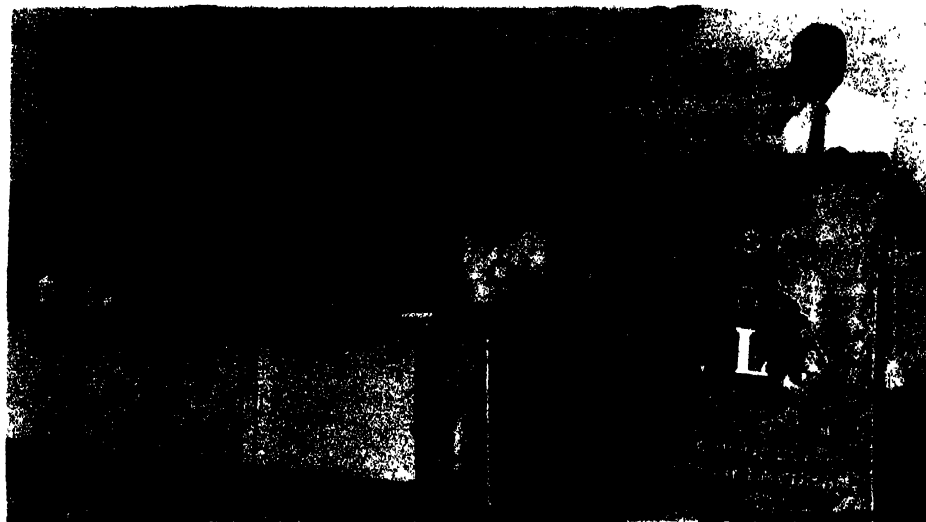
Maintenance strategies: An exercise has been taken up to define maintenance strategies and intervention criteria for different categories of roads. To define the total maintenance strategy, three types of strategies have been distinguished and considered — timing strategies, technology strategies and technique specific strategies. The strategies for choice of appropriate techniques are based on the type of maintenance activity-structural, functional, orientation of surface integrity and stability, and the class of road. □

Seminars, Workshops and Conferences

SOLAR '95 at CECRI

THE "SOLAR'95 - National Seminar on Solar Energy for the Common man" sponsored by Lions Club of Karaikudi Alagappapuram and Lions Club International Dist 324-B-3 was organized by CECRI, Karaikudi, during 6-7, January 1995. K.A. Sundaram,

I.A.S., Chairman & Managing Director, Tamil Nadu Energy Development Agency (TEDA), Madras, inaugurated the seminar and highlighted the activities and achievements of TEDA in Tamil Nadu and future planning of TEDA. The seminar was presided over by Prof. G.V. Subba Rao, Director, CECRI. Lion M. Raghavan, Scientist, CECRI, and Chairman of the SOLAR '95 organising committee, Lion S.P. Annamalai, District Governor of Lions Club International Dist 324-B-3, Dr. K. Balakrishnan, Deputy Director, CECRI, Lion L. Sundararajan, Regional Chairman and Lion S. John, Scientist, CECRI, and convenor of SOLAR '95 participated in the seminar. 60 research papers and five invited talks were received for the seminar which were contributed by scientists working in all parts of the country. An exhibition of "Solar Energy Devices" was held. A souvenir on the Solar '95 containing abstracts of all the contributed research papers was released. Five technical sessions were held and the research papers were presented along with four invited talks. The five themes of the technical sessions were: (1) Solar Thermal Systems, (2) Photovoltaics, (3)



Prof. G.V. Subba Rao, Director, CECRI, giving the Presidential address at the SOLAR '95 seminar

Solar Architectural applications and case studies, (4) Wind Energy and Biomass, and (5) Integrated Energy and Awareness of Solar Energy. After the technical sessions, several issues were discussed and the following recommendations made, which were forwarded to TEDA:

(1) The CECRI scientists working on corrosion science and engineering were requested to look into the impact of corrosion on solar devices; (2) As an experimental solar pond is expected to be built for research in the locality, CECRI and Alagappa University may join hands to establish the same for conducting utilization experiments. TEDA was requested to provide all the cooperation for successful establishment of the pond; (3) As the oxidised coating of stainless steel offers an excellent and economical solar absorbing layer (developed by CECRI scientists) every opportunity should be investigated to commercialise the process; (4) To popularise the use of solar energy among the public, a Solar Energy Park (SEP) may be established utilizing the expertise available locally in the campus of CECRI; (5) Utilization of solar energy in electrochemical and other energy-consuming industries should be encouraged; (6) CECRI may be requested to conduct solar energy seminars once every year to expose the valuable research conducted at CECRI in solar energy utilization to outsiders; (7) A quarterly journal containing investigations, research and information in solar energy may be brought out with financial support from DST; (8) Energy auditing in industries should be encouraged by making it mandatory; (9) Subsidies available earlier for solar cooker and flat plate collector may be revived; and (10) Hostels, hospitals, big hotels and guest houses may be requested to install solar water heaters. □

Medicinal Plants of India

A one day International workshop on 'Medicinal Plants of India' was held at the Central Drug Research Institute, Lucknow, on November 16, 1994 as a pre-Congress activity of the fourth International Congress of Ethnobiology held at NBRI, Lucknow, from November 17 to 21, 1994. The workshop was attended by 42 participants, including 14 representing eight foreign countries. The workshop was organized mainly to acquaint the participants with the research conducted on Indian medicinal plants through a series of lectures delivered by several eminent scientists.

Inaugurating the workshop, Dr. G.V. Satyavati, the Director General, Indian Council of Medical Research, said that Ayurveda is a comprehensive science which deals with health in totality and is not merely a system of treating diseases. Describing the development of the hypolipidemic Gugulipid from gum guggulu, Dr. Satyavati highlighted the importance of the approach that Ayurveda follows in the management of diseases. She

argued that India should be able to develop anti-cancers, immunomodulators, contraceptives, and drugs for rheumatoid arthritis, etc., if the principles enunciated in Ayurveda are carefully followed. Expressing her concern at the likely impact of patenting on the life of the common man after the signing of the GATT, Dr. Satyavati hoped that steps would be taken to conserve our genetic resources.

Dr. Nitya Nand, the former Director of CDRI, explained how the lead provided by Dr. Satyavati's work was followed up by detailed chemical, biochemical, toxicological and clinical experimentation in a rigorous manner for more than two decades to develop a well defined hypolipidemic drug. The Director of CDRI, Dr. V.P. Kamboj, described in detail the findings of research on more than 3400 plant species which have been tested at CDRI, of which some 700 active leads have been obtained. Dr. Kamboj called upon scientists as well R&D funding agencies to support and conduct extensive research programmes to put to use a large number of medicinal plants mentioned in the Indian traditional systems of medicine. He said that



Dr. V.P. Kamboj, Director, CDRI, welcoming the participants of workshop on 'Medicinal Plants of India'. Seated on the dais are Dr G.V. Satyavati, DG, ICMR, Dr R.C. Srimal, Director, ITRC, and Dr B.N. Mehrotra, Scientist, CDRI, Lucknow

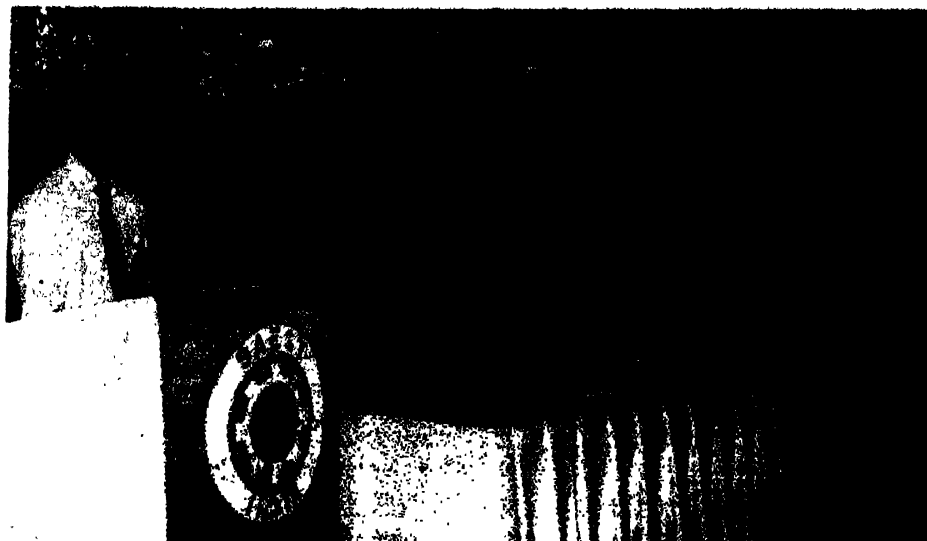
the research on Indian plants done at CDRI has already led to the development of a cervical dilator, a spermicidal cream, besides the hypolipidemic gugulip. A hepatoprotective, an anti-malarial, an anti-inflammatory and an anti-filarial plant products were also in advanced stages of development.

Prof. S.S. Handa of Punjab University, Chandigarh, emphasized the role of standardization and quality control in traditional medicines. He described at length the approach and various methods adopted in his laboratory for the standardization of crude drugs as well as formulations of traditional medicine. Prof. V.K. Joshi of the Institute of Medical Sciences, Varanasi, gave several examples to highlight the importance of the Ayurvedic system in treating several chronic and complex diseases.

In the concluding session, the participants were given certificates by Dr. Nitya Nand. Speaking on the occasion, Dr. Nitya Nand felt that such workshops gave insights into the wealth of knowledge and potential that is available in Indian medicinal plants. Several participants expressed their happiness at the organization of the workshop which exposed them to several aspects of these plants. Earlier, Dr. B.N. Mehrotra of the CDRI, the convenor of the workshop, extended a formal vote of thanks to all the participants as well as faculty members for excellent response that the workshop received. □

Electrochemistry in Marine Environment

A national symposium on 'Electrochemistry in Marine Environment' was organized by the Society for Advancement of Electrochemical Science & Technology Madras Chapter, Central Electrochemical Research Insti-



National symposium on 'Electrochemistry in Marine Environment' in progress

tute, Karaikudi, and the Department of Ocean Development, New Delhi, during 7-8 February '95 at Madras. The symposium was inaugurated by Shri C. Thangaraju, Chairman, Tamil Nadu Pollution Control Board, Madras. Prof. G. V. Subba Rao, Director, CECRI, gave the welcome speech. Dr C.S.P. Iyer, Head, C Mars, Regional Research Laboratory, Trivandrum, gave the Presidential address. Dr. J.S. Mani, Asstt. Professor, Ocean Engineering Centre, Indian Institute of Technology, Madras, delivered the keynote address on 'Dynamic marine environment'. Dr B.R. Subramaniam, Principal Scientific officer, DOD, New Delhi, released the souvenir brought out on the occasion. Shri K.M. Motwani, Chairman, SAEST Madras Chapter presented mementos to the organisers/ patrons/co-sponsors. Invited lectures and original contributory papers were given in the following areas: (1) Dynamic marine environment (2) Marine pollution and monitoring (3) Marine corrosion and biofouling (4) On line instrumentation (5) Recovery of sea products; and (6) Sea water quality for industrial applications.

The following resolutions were passed at the concluding session of the symposium: (1) The Department of Ocean Development should be requested to continue regular monitoring of marine environment, especially that of the coastal zone, and that suitable corrective action should be carried out by the concerned State Pollution Control Boards, wherever the pollution loads are high; (2) The panchayats, municipalities and corporations situated near the coast should be made aware of the fecal pollution all along the coast so that control measures can be undertaken by them for proper sewerage treatment before discharge into sea; (3) Environmental Impact Assessment should be made mandatory, whenever an aquaculture farm of area more than 100 acres is planned to be set up. Farms of smaller size should be clustered with a common effluent treatment system; (4) The Central Government and the concerned State Governments should give utmost priority to the disposal of fly ash arising out of operation of thermal power plants. Impetus should be given to the national laboratories, universities, etc. to undertake R&D work for utilisation of the fly ash in

different areas. In this context, the Department of Environment should be requested to include the Tuticorin area as one of the sensitive ecosystems; and (5) the Central Government and State Governments should encourage R&D work related to the development of suitable sensors for monitoring of pollutants *in situ* and also for the development of environment-friendly methods for controlling biofouling in power plants, offshore platforms, etc. □

Marine Biotechnology

THE Department of Biotechnology (DBT), Ministry of Science and Technology, Government of India, organised a 'Brain Storming Session on Marine Biotechnology' at the National Institute of Oceanography (NIO), Goa, to identify important and emerging areas of research. The session was inaugurated by Dr. S.N. Dwivedi, Emeritus Scientist, NIO, on 16 January, 1995 which was followed by keynote address by Dr. John George, Director, Department of

Biotechnology. He explained the importance of and genesis for organizing the session. Dr. E. Desa, Director, National Institute of Oceanography, Goa, presided over the session.

The following major areas were discussed during the session: (a) Marine biomedical and pharmaceuticals; (b) Industrial chemicals, enzymes and useful products from marine algae, bacteria and other aquaculture species; (c) Production of toxins from marine algae, corals and sponges; (d) Disease diagnostics/biofouling/tissue and cell culture; and (e) Marine pollution/waste disposal. The session was attended by 20 resource persons from various fields. The areas of collaboration with the DBT were also explored. □

Oil Conservation Week at IIP

DURING the Oil Conservation Week observed all over the country, from 13 to 19 February, 1995, a variety of programmes

were organized by Indian Institute of Petroleum (IIP), Dehradun. This year emphasis was laid on educating students and villagers of Dehradun and its surrounding areas about the importance of conservation of petroleum products by their efficient utilization.

The week long activities were inaugurated in the Town Hall of Dehradun city by V.R. Sista, Deputy Director, IIP, on 13th February. A 'Students meet' was also organized. Senior scientists of IIP educated the students through their talks on the importance of conservation of petroleum products. About 250 students from various schools of Dehradun city attended the meet.

On 14th February 1995, a team of IIP scientists and other technical staff conducted exhaust emission tests on scooters and cars at Abner Petrol Pump in the heart of Dehradun city from 11.30 AM to 3.30 PM. There was a lot of enthusiasm among the owners of the vehicles and about 130 persons got their vehicles tested. IIP scientists also

Training Programme

Sanitaryware at CGCRI

A training-cum-demonstration programme on 'Manufacture of sanitaryware' incorporating raw materials available at Khurja, was conducted at CGCRI, Khurja Centre, from 12 to 20 December 1994. As many as 18 participants from different parts of the country attended the programme. The course composed of both theoretical lectures as well as practical demonstrations, including firing in an oil fired shuttle kiln on a semi-commercial scale. One of the participants has already made use of the technology on a commercial scale in his newly set up unit. □



Demonstration of sanitaryware in progress at CGCRI, Khurja

NIO Foundation Day

THE National Institute of Oceanography (NIO), Goa, celebrated its Foundation Day on 18 January, 1995. The Foundation Day lecture on 'Scientific Research and Government Support' was delivered by the renowned nuclear scientist Dr. Raja Ramanna, presently the Director of the National Institute of Advanced Studies, Bangalore, at Menezes Braganza Hall, Panjim.

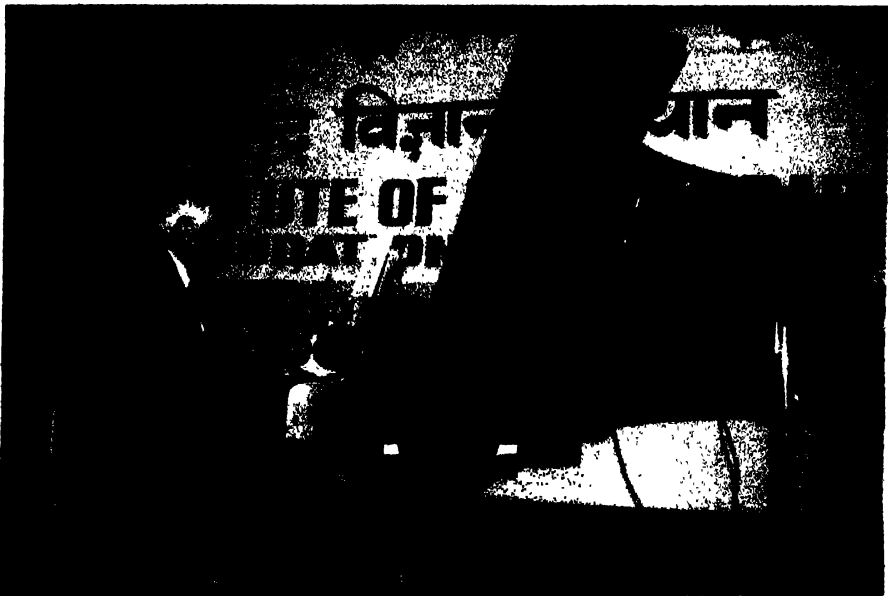
In his speech, Dr. Ramanna noted that Indian research must be qualitative to compete worldwide, especially after the measures taken by the Government to liberalise economy, which meant that the process of globalisation was on in the country. He stressed that the Government must concentrate more on transferring benefits of research to the masses. Indian research must serve the community and various other public utility services, he felt. He also added that it is important that industries too should go in for research in a big way for self-reliance.

Dr. Ramanna said India has made tremendous progress in the field of science and technology since Independence but if we are to survive we must compete. "We must aim at creating proper facilities for Indian scientists and aim at results", he pointed out, and felt that one of the reasons for brain drain was a few incentives for research in the country.

In his inaugural address Shri Pratapsing Rane, Chief Minister of Goa, remarked that scientists should utilise their research for safeguarding human lives and in creating a pollution-free world. In this context the NIO can play a significant role, he added. He ap-



A view of the illuminated building of the National Institute of Oceanography, Goa, on the occasion of the Foundation Day



Dr Raja Ramanna giving piano recital on the Foundation Day of NIO, Goa

plauded the quantity of research carried out at the NIO.

Earlier, Dr. Rabin Sen Gupta, Emeritus Scientist, NIO, traced the genesis of the institute and Dr. E. Desa, Director, NIO, wel-

comed the gathering. The Foundation day lecture was followed by piano recital by Dr. Ramanna and a cultural programme. The institute was kept open for the general public. □



Demonstration on oil conservation during the Oil Conservation Week celebrated at I.I.P., Dehradun

distributed literature and stickers on oil conservation to the owners of the vehicles on that day.

On 15th and 17th February, 1995, a team of IIP scientists visited Selakui and Vikas Nagar village Blocks and talked to villagers, particularly women folk, about the proper utilization of LPG, kerosene and diesel fuels. Video films on fuel-saving tips were also shown on the occasion and pamphlets and stickers on oil conservation distributed. A Quiz and Painting competition on Oil Conservation for school students was organized at IIP Campus on 16th February, 1995. About 10 schools participated in this competition and prizes were awarded to winners. □

Doctorates

B. Nagender Nath

B. Nagender Nath, Scientist, Geological Oceanography, National Institute of Oceanography, Goa, has been awarded Ph.D. degree by the Goa University for his thesis on 'Rare earth element geochemistry

of ferromanganese nodules, crusts and sediments of the Indian Ocean'. He did research under the guidance of R.R.Nair, Deputy Director, National Institute of Oceanography.



Nath's research is a comparative study of the rare earth element (REE) uptake behaviour by various sedimentary phases, including the ferromanganese deposits of the Indian Ocean, and involved analysis of 53 samples of different sedimentary types such as fresh water, brackish water and inner-continental shelf/near-shore marine, deep-sea terrigenous, siliceous, calcareous, pelagic/red clay sediments and ferromanganese formations. The study contributes to the

understanding of (1) continental and hydrothermal inputs patterns/fluxes of REE into the Indian Ocean; (2) relative enrichment of REE in these phases in comparison to the upper crust composition; and (3) REE sorption mechanisms.

Nath has been associated with the project 'Surveys for polymetallic nodules' since 1982. He participated in a number of cruises onboard the Indian and other research vessels. He was on prestigious DAAD (German Academic Exchange Service) Fellowship at the Aachen University of Technology, Germany, from 1989 to 1991, where he gained advanced knowledge on REE geochemistry. With over 24 publications to his credit Nath is currently engaged on the studies of the Indian mine site in the Indian Ocean and also in the current phases of deep sea photographic surveys, geochemical and mineralogical proxies for interpreting the past climatic changes in the oceanic regions on longer time scales.

M.V. Deshpande

DR M.V. Deshpande of Biochemical Sciences Division, NCL, Pune, has been awarded the D.Sc. degree by the University of Poona. □

Honours and Awards

M.C. Srinivasan

DR M.C. Srinivasan, Head, Division of Biochemical Science, NCL, Pune, was elected a Fellow of the Indian National Science Academy, New Delhi, in recognition of his contributions to microbial biodiversity and its application to industrial microbiology and enzyme technology.



Dr P. Ratnasamy, Acting Director, NCL, Pune, receiving the Highest Industrial Earning Award from R.F. Davidson on behalf of Catalysis Division of NCL on the NCL Foundation Day celebrated on 3rd January '95. On the extreme left is Dr R.A. Mashelkar, Director, NCL

P. Ratnasamy

THE Catalysis Society of India has chosen Dr P. Ratnasamy, Head, Catalysis Division, and Acting Director, NCL, Pune, for the 'Eminent Scientist Award'. The award was presented to him during the 12th National Symposium on Catalysis held between 19 and 22 December 1994, at BARC, Bombay. Dr. Ratnasamy delivered a keynote Award Lecture at the symposium.

S. Sivasanker, R.S. Nadgauda and R.V. Chaudhari

THREE NCL scientists Dr S. Sivasanker of Catalysis Division, Dr (Mrs.) R.S. Nadgauda of PTC Division, and Dr R. V. Chaudhari of Chemical Engineering Division received the VASVIK Award from Shivraj Patil, Speaker, Lok Sabha, on 26 November 1994. Dr Chaudhari received the Award *in absentia*.

S. Sivasankar and V.S. Patwardhan

TWO NCL scientists Dr. S. Sivasankar of Catalysis Division and Dr. V.S. Patwardhan of Chemical Engineering Division have been elected Fellows of the Indian Academy of Sciences. Dr. Sivasanker has been responsible for the development of many novel catalysts and catalyst-based technologies with applications in petroleum refining and petrochemical products, many of which are eco-friendly. The main research interests of Dr. Patwardhan are in the application of mathematical modelling and computer simulation techniques to problems in chemical engineering.

R.N. Sharma

DR. R.N. Sharma, Head, Entomology Group, OCS Division, NCL, Pune, has been elected a Fellow of the National Academy of Agricultural Sciences, New Delhi, for his

contributions to public health and agriculture. **Uttarpore Jaykrishna Public**
P.O.-Uttarpore Dist - Ho
Pin-712268

Rajiv Kumar

DR. Rajiv Kumar, Scientist, Catalysis Division, NCL, Pune, was chosen for the Sistla Kameshwari Siddhati's 'Young Scientist Award' by the Catalysis Society of India.

S. Radhakrishnan

DR. S. Radhakrishnan of Chemical Engineering Division, NCL, Pune, has been elected Member of the Institute of Physics, U.K.

Dr Radhakrishnan has been authorized by the Institute to describe himself as a 'Chartered Physicist'.

V.V. Ranade

THE Indian Academy of Sciences, Bangalore, has chosen Dr V.V. Ranade of Chemical Engineering Division, NCL, Pune, as a *Young Associate* in recognition of his scientific contributions in the area of mathematical modelling of industrial flow processes.

R.R. Hirwani

R.R. Hirwani, Head, Project Planning and Development Unit, NCL, Pune, has left for the USA to take up the Hubert H. Humphrey Fellowship Program of the United States Information Agency. The Fellowship is awarded annually to accomplished professionals from the Third World countries, with a public service orientation and committed to their own countries' development. This is the first time that a scientist from India's S & T establishment has been selected for this prestigious fellowship. □

NML-Galvasave Knowhow transferred

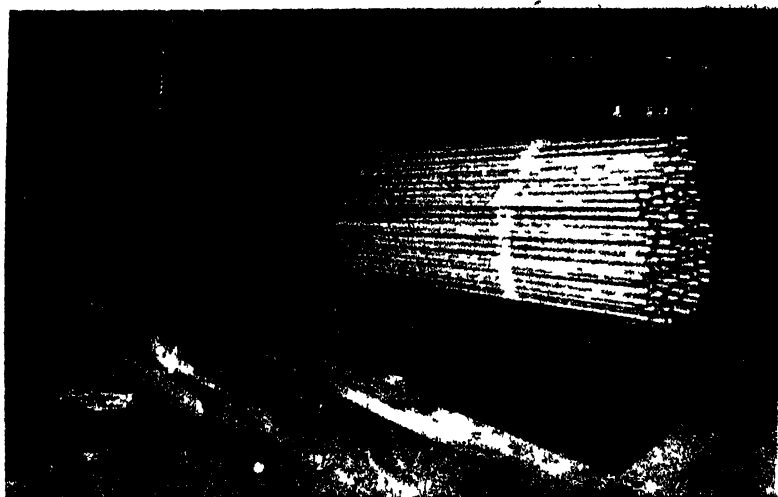
METOIL Corporation, Jamshedpur, has proposed to set up an industry based on NML-Galvasave knowhow. An agreement has been signed to this effect. M/s Metoil Corporation has agreed to deposit Rs 3.20 lakhs as lump sum fee and a recurring royalty at the rate of Rs 2 00 per litre of the product for seven years. Earlier, NML-Galvasave has been successfully evaluated at the Tube Division of Tata

Steel for over one year and has emerged a superior product compared to others in as far as corrosion resistance, consumption rate, ease of operation, and pollution problems are concerned.

NML-Galvasave is a passivator which imparts a surface conversion protective coating on zinc and galvanized surface. Galvanized surfaces are extremely active and prone to attack by polluted atmosphere forming zinc carbonate or chloride. These salts are highly soluble and conducting in na-

tural and polluted atmosphere. This conductive salt film causes deposit therefore appears on the surface which is known as white rust. This white rust is detrimental to the life of the coating and also affects the sacrificial action of zinc on steel. Aesthetically also it is a serious problem for galvanized products. To overcome white rust the active surfaces are passivated by using suitable chemicals which impart a highly corrosion-resistant film on the galvanized surface of the products. The passivators available in the market are based on hexavalent chromium which is highly carcinogenic and objectionable from health point of view. Some other products that incorporate low quantity of hexavalent chromium in their formulations are based on foreign technology and incorporate certain imported raw materials.

The NML developed passivator, known as 'Galvasave-B', is a low hexavalent chromium based product which imparts very high corrosion resistance to zinc and galvanized surfaces. It is effective at lower concentrations compared to the other products available in the country based on imported technology. □

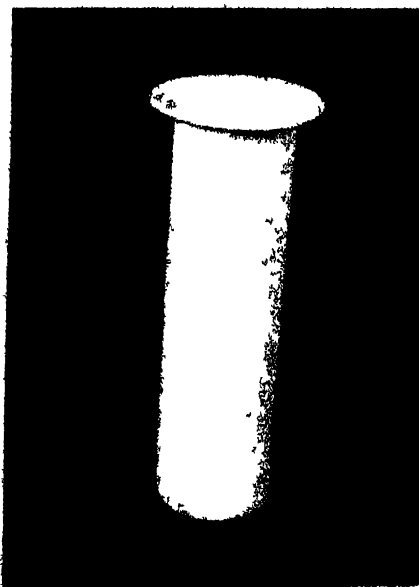


NML's Galvasave under trial at the Tube Division of Tata Steel

CGCRI made ferrules installed in Mathura Refinery

INDIAN Oil Corporation Ltd., Mathura Refinery, Mathura, requested the CGCRI, Khurja, to fabricate and supply 600 ceramic ferrules for installation in exchange tubes of its sulphur recovery unit.

The ferrules were originally imported and supplied by an Indian organization to Mathura Refinery at the time of installation. The product is supposed to be used at temperature of 1280°C maximum and is exposed to different corrosive fumes, viz., SO_2 ,



SO_3 , H_2S gases, etc. Another important requirement of the product is the extreme dimensional accuracy.

After several trials, one composition was selected for fabrication of the ferrules adopting slip casting method. The different process parameters were judiciously controlled to get the dimensional accuracy.

The work was undertaken on job contract basis and initially 200 ferrules were supplied for trial purpose. Later 400 ferrules were supplied. The concerned authorities expressed satisfaction over the performance of the ferrules in their unit. □

Printed and Published by Dr G P Phondke, Director, Publications & Information Directorate (PID), Dr K S Krishnan Marg, New Delhi - 110 012
Printed at PID Printing Unit

Editors : Dr B.C. Kashyap, Dilip M. Salvi and Madhu Sahni
Phone 5786301 Gram PUBLIFORM

Production : Kaushal Kishore
Telex 031-77271
RN 4512/57

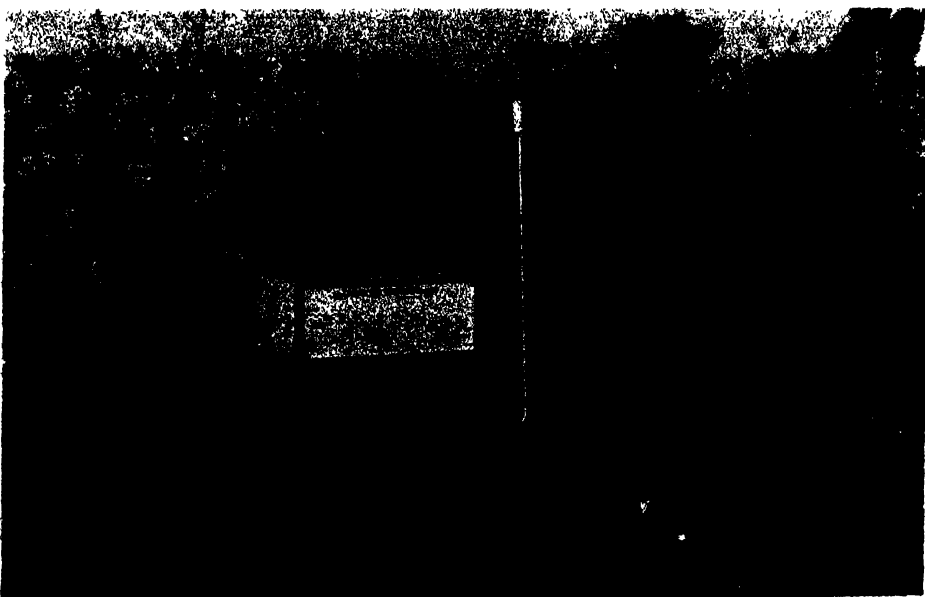
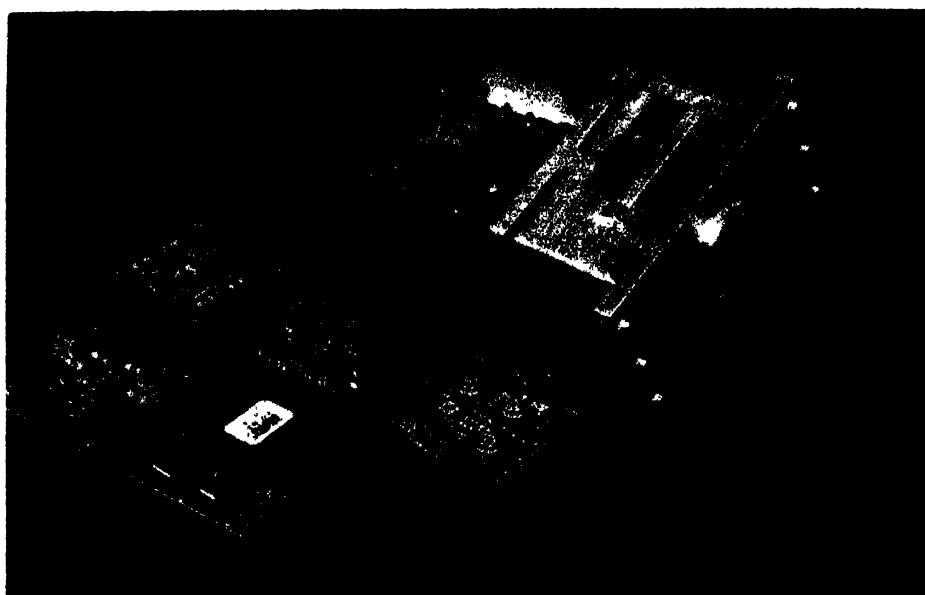
Annual Subscription : Rs. 60
Single Copy : Rs. 3.00

E-mail pid@srinethernet.in Fax: 5787062

CSIR

NEWS

VOL 45 NO 8 30 APRIL 1995



IN THIS ISSUE

National Institute of Science, Technology and Development, S&T Highlights: 1993-94	124
N.V. Raman, Director, SERC-Madras, lays down office	125
Raj Mahindra — a tribute	126
Amplifier for Electromagnetic Actuator	126
Automatic Irrigation System	127

Pulse width modulated amplifier for position control of electromagnetic actuator (Top). Micro-controller based Automatic Drip Irrigation System (Bottom). Both the devices are developed by Central Electronics Engineering Research Institute, Pilani

National Institute of Science, Technology and Development Studies, New Delhi

S & T Highlights : 1993-94

IN tune with the emphasis on globalization, the National Institute of Science, Technology and Development Studies, (NISTADS) New Delhi, launched an international team for undertaking a major assignment from the International Development Research Council, Canada, and the Danish International Development Agency during 1993-94. NISTADS partners in this project on Research Technology Organisation and Small and Medium Enterprise Development are from World Association of Industrial Research Organisations, Danish Technological Institute and Saskatchewan Research Council. This is believed to be a significant development resulting from sustained work put in over the years towards publishing results in journals and of conducting user-oriented studies for Indian clients.

Another major highlight of 1993-94 has been the successful development of a computerized system 'IMPACT' (Integrated Management of Project Accounting) jointly with CSIR. Areawise significant achievements and results of studies are briefly described in the following:

Mathematical Modelling

An attempt has been made to apply Fish and Pry model to the Indian economy to describe technological growth on the basis of competition. Five cases of technology substitution were analyzed to make forecasts up to 2010 A.D.

An evolutionary model of firm size distribution display marked inequality in spite of the economic theory of perfect competition which predicts an optimum firm size based on a simple model of 'cumu-

lative advantage'. Beginning from a homogeneous population, incremental relative advantage is captured by a few firms. Successive application of this rule results in a skewed distribution.

The growth of the computer industry in India has exceeded the projections made for the Seventh Plan period 1985-90. Short-term forecasts of sales of 35 top Indian computer firms that account for nearly 75% of the sales of the total industry are made. Standard forecasting models are assessed in terms of forecast accuracy at the firm level.

Neural model of publication behaviour was simulated in which the body of journals is regarded as the collective memory of an academic community. Successive generations of papers are produced by transfer of information to members of the community. As the nature of information becomes more diffused, it acquires the character of common knowledge, and lowers the learning threshold by creating a citation network. A new paper becomes a node in this connected network which defines the paradigm and delimits the community. Obsolescence is modelled by ensuring that only current publications serve to transfer information, while older papers contribute to growing knowledge in the system.

Technology and Social Change

As part of DBT (Department of Biotechnology) sponsored project on 'Tissue Culture Cardamom-Product Plant', a socio-economic impact assessment of the new technology was undertaken. The main objective of this impact assessment project was to assess the

impact of technological intervention on the productivity differentials between adopters and non-adopters. The baseline survey report was presented to the Spices Board. All the beneficiaries and non-beneficiaries were selected from the villages in 15 zones in Karnataka, Kerala and Tamil Nadu. The survey covered cropping systems, costs of cultivation, productivity, marketing, income and assets details. On most of these variables, beneficiaries reported higher averages than non-beneficiaries in all the States. These differences indicate a bias in selecting beneficiaries who have established large and well-equipped plantations.

A study on prospects of products based on biotechnology by 2000 AD in India has been completed. The report of products based on enzyme engineering, which might reach the market, has been submitted to TIFAC. The major finding of the study is that, though the suitability and flexibility of the enzyme engineering technology is high, preparedness of TDS is low. There are two main reasons for this: (i) there is no concern for quality by consumers; and (ii) there is hesitation on the part of concerned industry to invest in modernizing their established production setup.

Second round of Delphi was conducted on manpower projections in biotechnology by 2000 AD in India to reduce the variations in predictions during the first round. As expected, there was an increased level of consensus among the respondents in the second round for estimates of manpower

in enzymes engineering, plant tissue culture and hybridoma.

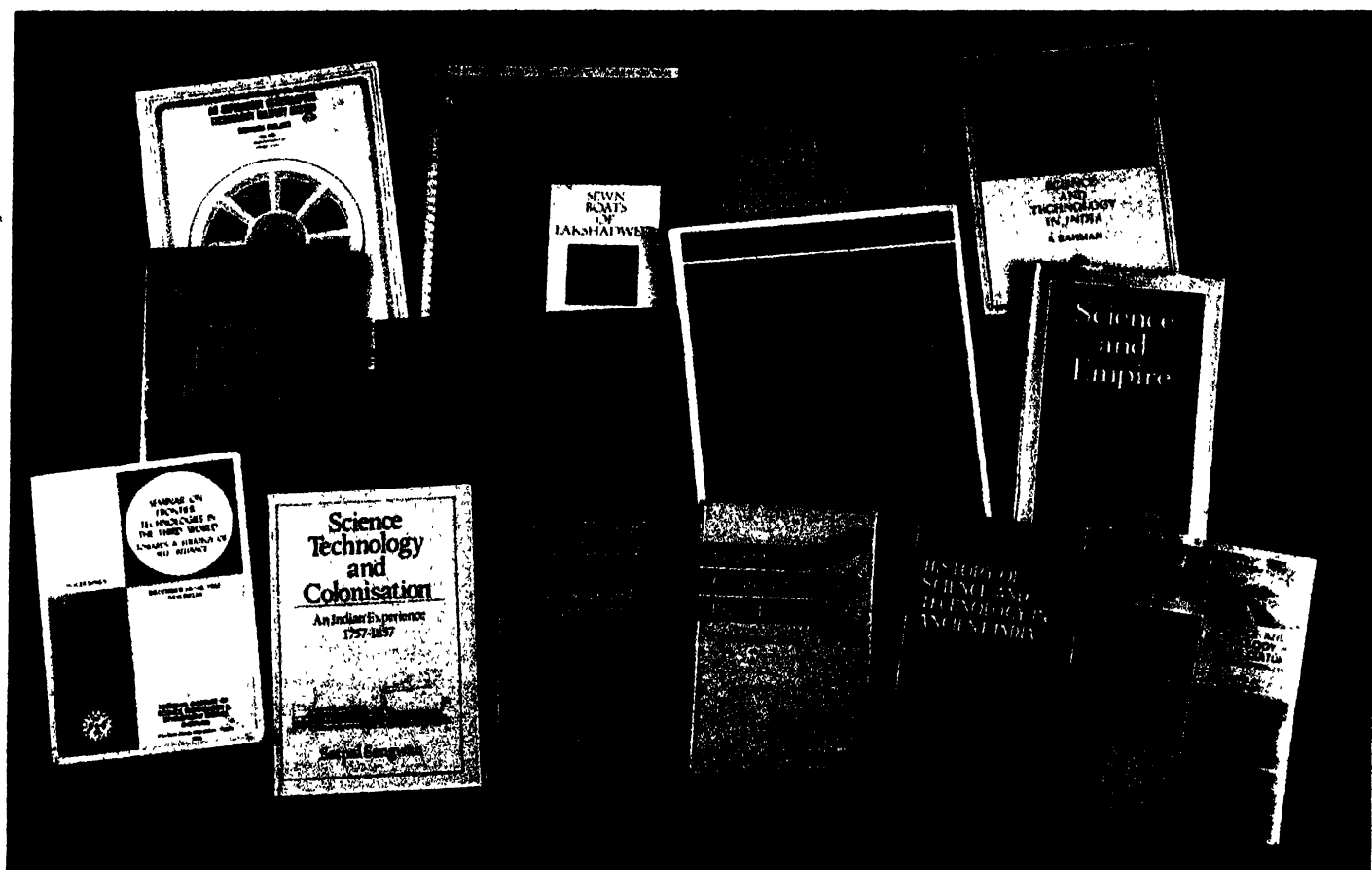
Information on multinational corporations in India is being computerized using CDS/ISIS database. The information is located in two directories, one on MNCs and the other on Indian subsidiaries. The records on MNCs have data on their addresses, company of origin, fortune, rank, nature of major subsidiaries, total sales, and the names of the Indian subsidiaries. The records of Indian subsidiaries have data on addresses, share of equity held by the foreign companies, major activities, total sales and total profits. A critical analysis of the new *sui generis* legislation has been made.

A survey of fifty electronics related firms based in Delhi has been conducted on organizational and technology profiles. Most of the computer companies are in the growing stage and supported with very little R & D to production line infrastructure but have got high sales turnover. Although the technology profile is not correctly reflected, most of these companies are importing technologies by outrightly purchasing drawings and designs and absorbing it with the expertise available within the companies to local conditions.

The status of technology absorption in Indian polymer industry was examined. It was found that although imported technology was absorbed under local conditions, no major improvements or

technology innovations have taken place indigenously. Major weaknesses persist in the area of catalysts. Some of the factors inhibiting efficient utilization of available technology are relatively small plant sizes, long implementation times, high duties and tariffs, and lack of effort in technology absorption and commercialization of available R & D efforts.

A study was done on technological change by taking a case of black and white TV picture tube technology in three firms in India. It is concluded that along with in-house R & D, sustained strong linkages have to be built up with national R & D institutions and laboratories to narrow down the technological gap with the advanced countries.



Major research publications on science, technology and development issues brought out by the National Institute of Science, Technology and Development Studies, New Delhi



Map showing variations in water table in Bichwa range of Chindwara district, M.P., prepared for the management of forests

Science and Technology Indicators

A few interesting findings in this area are: agricultural sciences accounted for the maximum number of awards accorded to scientists during the period 1985-90, closely followed by medical sciences; in respect of citations per paper, chemical sciences performed better than biological sciences; agriculture has the highest normalized impact per paper followed by earth and space sciences and engineering sciences; and relative quality index is the highest in agriculture and least in life sciences.

An opinion survey of scientists and engineers in R & D institutions and industrial firms was carried out on the draft New Technology Policy. Comparative views of these two groups of respondents have been presented. Encouragement to

traditional skills and reduction of drudgery of women and the weaker sections of society has received lowest rating from both the groups. The industry respondents claim strongest capabilities in adaptation and absorption of foreign technology and in technologies that are internationally competitive in quality and standards. R & D institutions do not see adaptation and absorption of foreign technologies as their strongest capability. Their strongest capability is in developing technologies based on indigenous resources. While industry is almost equally divided on the issue of whether there are enough job prospects for increased number of S & T manpower (52 % yes and 47 % no), about 56 % of the R & D institutions do not see enough job prospects and within this the most pessimistic is the CSIR group (65 % responding in the negative)! The

industry is almost unanimous in its opinion (90 %) that fiscal incentives on R & D will bring significant changes in taking initiatives in in-house R & D. Comparatively, the CSIR responses indicate that as many as 32 % do not agree with this. While a majority of respondents from industry see delicensing as an instrument for improving the technological competitiveness (64 %), 51 % respondents from CSIR do not see delicensing as an instrument for improving the technological capability while the majority of other R & D institutions share the perception of industry (55 %).

History and Philosophy

Work has been done on the question of science and morality and the institutional embodiment of the debate which took place within the Bhadraklok circles on science, tech-

nical education and industrialization. The role of a mid-19th century intellectual, Munshi Zakauallah, was looked into in the dissemination of modern science and scientific ideas. He was an ardent advocate of local language as the medium of instruction, particularly for the teaching of modern science.

Resource Planning and Utilization

A pilot scale study on the working plan pertaining to Bichwa range of Chindwara district in Madhya Pradesh was carried out with the help of remote sensing and departmental data. Maps on drainage, geology, settlement, soil, land use, forest types, hydrology, forest extent and density, working circles and socio-economic aspects have been prepared. A GIS (Geographical Information System) has been developed for micro-level planning of forest activities of the range.

Five training programmes of one week duration each were organized on 'Pollution Information System Using Remote Sensing and GIS'. The trainees were officers of Central and State Pollution Control Boards and supervisory officers, and administrators of the Ministry of Environment.

Training for the benefit of rural artisans were organized in Bankura district in the areas of pottery, brass and bell metal and leather training. The focus of the training was on upgradation and modernization of traditional technologies.

Information Systems and Archival Resources

Databases have been created on journals covered by SCI, impact factors of journals, Indian research output from 1988 to 1992 and the CSIR staff. A software package of Devnagri version of CDS/ISIS 2.3 and CDS/ISIS Pascal interface has been developed. This package is be-

ing distributed by NISSAT. It is also given to Nepal and Bangladesh.

Private papers of Dr. S. Varadarajan, Prof. Yash Pal and Prof. A. Rahman were screened, documented and preserved. The records of their papers have been computerized.

Studies for the CSIR

As a contribution to the Centenary Year of Dr. S.S. Bhatnagar, a volume on *S.S. Bhatnagar on Science, Technology and Development — 1938-54* was published. It contains twenty three papers written by Dr. S.S. Bhatnagar. Also a film on Dr. Bhatnagar was produced and screened in almost all the CSIR laboratories. An exhibition on his life and works was produced.

NISTADS, CSIR Complex and CIMAP have developed a computer software for 'Integrated Management & Project Accounting' (IMPACT) for CSIR. The new computerized system is in operation in CSIR from April 1994.

International Studies

A comparative study of India and China was carried out on the import of technology for the development of domestic machine building industry. The machine building industry has been mainly built up both in China and India. India has continued to adopt a more selective approach in contrast to China which adopted a highly liberalized approach in imports of technologies since the eighties. Average foreign investment per joint project was US \$ 1.82 million in China as compared to \$ 0.41 in India. This shows that China has been able to acquire more advanced technologies. India has achieved indigenization level of 80-90 % for components and parts of machinery and equipment which, in case of China, is 60-70%. In case of automobile sector there is only 30-40 % indigenization in China which in case of India is 80-90 %. Domestic

Services Offered by NISTADS

SCIENCE and Technology Policy related studies and analyses: (i) Planning, organization and management of science; (ii) Social relations of science; (iii) Applications of Geographic Information System for sector planning at regional level; (iv) Technology assessment and forecasting; (v) Technology development, acquisition and transfer, including comparisons between countries/regions; (vi) Bibliometric studies to determine global excellence centres, institutional and subject linkages, historical trends, etc; (vii) Women issues in S & T.

Information Systems Design/Databases: (i) S & T indicators; (ii) R & D project management; (iii) Decentralised management of natural resources for regional development; (iv) Bibliographic and non-bibliographic data; (v) Software development : fonts for Indian languages, multilingual graphic-user interface for databases and text.

Survey Studies: (i) Impact assessment, (ii) Techno-economic surveys for rural development; (iii) Opinion surveys on S&T related issues.

Information Supply: (i) Science & technology archival records available in various Indian archives; (ii) Literature on science policy; (iii) S & T indicators; (iv) Research material for film making on eminent Indian scientists and S & T related public issues in India.

Training: To scientists and officials from S & T agencies, R & D organisations and central and local government bodies from India and other developing countries in the above listed areas of expertise of the Institute. □

bidding in China is very low in comparison to India. For example, to manufacture power plants the domestic response for China is only 20 %; in case of India it is 80 %. The study brings out that in both India and China there is no sufficient basis for motivating scientists for either generation of indigenous technology or improvement of imported technology. □

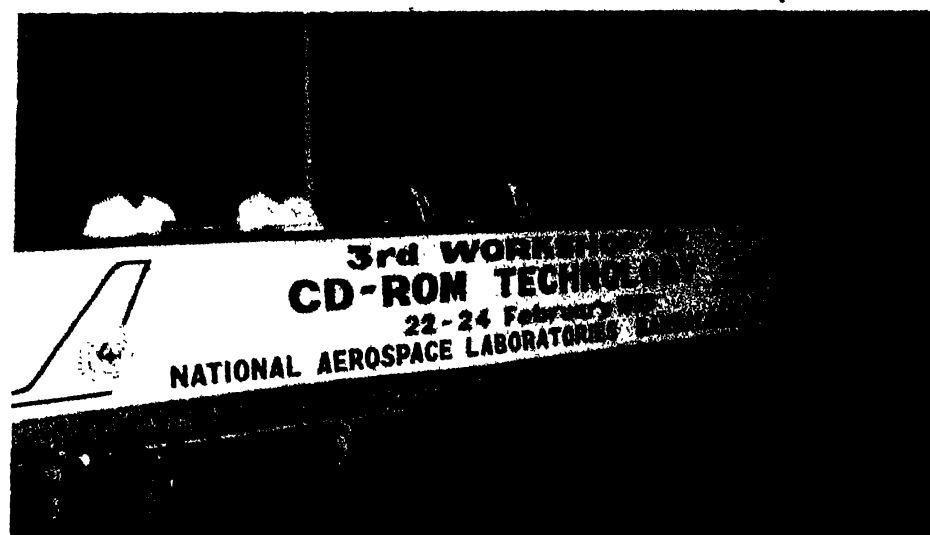
Symposia, Workshops and Conferences

CD-ROM Technology

A three-day workshop on CD-ROM Technology was jointly organized at National Aerospace Laboratories, Bangalore, from 22 to 24 February 1995 by National Information Centre for Compact Discs, ICAST, NAL, Bangalore, and NISSAT/DSIR, New Delhi. The workshop was attended by 30 members. Inaugurated by Dr. B.R. Somashekar, Acting Director, NAL, the keynote address was delivered by Dr. N.M. Malwad, Librarian, JRD Tata Memorial Library, Indian Institute of Science, Bangalore. Dr. A.K. Singh, Head, Materials Science Division and the Chairman, Library Committee, NAL, presided over the function.

While welcoming the delegates of the workshop, Mr. I.R.N. Goudar, Head, ICAST, NAL, explained the need for conducting such workshops for the benefit of Indian information professionals and users. He was very happy to note that the workshop was the third one in its series conducted by ICAST at NAL.

In his inaugural address Dr. Somashekar gave an account of the strong foundation laid by his predecessors to develop the Information Centre at NAL, which has a



Shri I.R.N. Goudar, Head, ICAST, N.A.L., welcoming participants to the CD-ROM workshop

comprehensive collection and all modern infrastructural facilities. He was happy to note that the Information Centre of NAL has a fully automated and well-maintained library and has made a good name by providing on-line and CD-ROM based information search facilities. He recalled the revolution created by the CD-ROM technology in dissemination of information. He said that the science and technology available in the country can be made available to other countries by exploiting the low cost storage media like CD-ROM to earn sizeable foreign exchange.

In his keynote address 'Changing Scenario of Information Storage Media', Dr. Malwad traced the developments of communication system right from the clay tablets to the latest hi-tech storage retrieval media, i.e., CD-ROM. He said that by the beginning of the 21st century, libraries would be dynamic information distribution centres through electronic media. However, he felt that the print media would exist despite the developments taking place in storing and dissemination of information through electronic gadgets in information technology.

In his Presidential remarks Dr. A.K. Singh hoped that the price of the CD-ROM would drastically come down consequent upon its large usage and thereby even the small libraries would be able to harness this new technology. Shri H.S.S. Murthy proposed a vote of thanks.

Shri P.V.R. Prasad of Rajaram Informatics, Bangalore, gave a lecture cum demonstration on Multimedia, which was attended by more than 200 persons apart from delegates of the workshop. Shri Goudar gave a bird's eye view of CD-ROM technology and explained CD-system requirements, developments, advantages, disadvantages and future trends. This was followed by a lecture on CD-ROM database acquisition, issues and solutions by Shri N.V. Satyanarayana, President, Informatics (India) Pvt. Ltd. He also gave an account of the latest hardware and software available and their compatibility in setting up of a CD-ROM system in a library. Shri A. Kottai of M/s. Software Support and Services, Bangalore, explained the steps involved in installing CD-ROM retrieval software taking the example of on-discs of DIALOG and SPIRS

of Silver Platter. Shri R. Chandrashekar, Informatics (India) Pvt. Ltd., while highlighting the trends in CD-Publishing, explained the steps involved and the budgetary requirements of CD. On the second day, Shri Goudar, in his lecture on 'CD-ROM Technology: World Scenario and Indian Experience' gave various statistics concerning CD-ROM and highlighted the number of published CD databases by countries, languages, publishers and their compatibilities to computers and operating systems, etc. He also gave an account of the adoption of this new technology in various libraries/Information centres in India. Shri Sreenivasa Ravi of NCSI, IISc., gave an account of CD-ROM standards and explained how these standards have overcome certain problems like their compatibility at various levels such as physical, logical and other applications. In his lecture on CD-ROM Search Software Dr. T.B. Rajashekar of NCSI explained the relationship between retrieval interface, retrieval engine and CD-ROM database and the mechanisms involved in the retrieval process. Smt Poornima Narayana of ICAST, NAL, gave an account of literature sources on CD-ROM technology such as journals, indexing and abstracting services, directories, handbooks, on-line and CD-ROM databases, list servers, etc.

On the third day of the workshop, Shri H.S. Subramanya of ICAST gave a brief account of the licensing and copyright issues concerning CD-ROM and suggested possible solutions. Dr.M.S. Mrdhar, Head, ISAC Library, Bangalore, explained the value of CD-ROM applications in libraries with library automation, retrospective conversion, current awareness service, resource sharing, development of local databases, collection development, reference service, etc. Shri H.S. Siddamalaiah, Li-

brarian, NIMHANS, Bangalore, gave a bird's eye view of CD-ROM database available in the area of food, agriculture and bio-medical science. Shri T.N. Prakash, Manager, Information Technology, ADA, Bangalore, gave an account of CD-ROM databases in the areas of business and management and also the standards and patents and their applications. Shri H.S.S. Murthy, ICAST, NAL, reviewed various CD-ROM databases available in physical, chemical and engineering sciences and explained in detail their contents and applications. In the post lunch sessions on the second and third days of the workshop, practical demonstrations/hands-on experience in searching popular CD-ROM database of DIALOG, Silver Platter, British Library, TFPL and Ulrich's Plus were arranged for the benefit of the participants. They were provided with the lists of CD-ROM databases in their respective areas.

An evaluation and the feedback of the workshop showed that the workshop was very helpful and the new technology should be adopted by various libraries taking the example of NICDROM Centre; most of the participants advocated for the organization of five day workshop so as to have more practical sessions and discussions.

A valedictory function was arranged in the evening. Shri M.N. Seetharaman, Ex-Head, ICAST, NAL, was the Chief Guest. Shri Anil Mohanlal Tataria of WISCAN, Vadodara, presided over the function. The programme concluded with a vote of thanks by Smt Poornima Narayana. □

Neurosciences

THE XIII Annual Conference of Indian Academy of Neurosciences was held at Christian Medical College, Vellore, from 27 February to 1 March, 1995. The

Institute of Aerospace Engineering set up

THE newly created Institute for Aerospace Engineering (IAE) was formally inaugurated by Dr C.G. Krishnadas Nair, MD, HAL Bangalore Complex (and now also President, Aeronautical Society of India) on 15 January 1995. The Institute, which is to be affiliated to the Aeronautical Society of India (AeSI), promises to fulfil a long felt need. According to the NAL-TIFAC civil aviation survey report released a few months ago, 5,000 trained aviation personnel in different categories are required in the country by the year 2000. But the number of establishments which train aerospace personnel in Bangalore is no more than a handful!

The new institute is seeking to correct this paradoxical situation. To start with, IAE would offer high quality coaching facilities to candidates preparing for the AeSI examinations. Later, the institute hopes to initiate distance education programmes, publish standard textbooks on the subject, and eventually even train and nurture aircraft maintenance engineers.

This should be a special institute with a special mission, Dr Nair told Shri P.S. Visvanathan, who is to be IAE's Chief Executive. The inaugural function also included brief remarks by Dr K. Ramachand, Director, CABS and President, AeSI, Bangalore Chapter, Prof K. Rajalah of ADE and Shri S.K. Chhabra of ASDE. □

conference was inaugurated by Prof. B.N. Dhawan, former Director, Central Drug Research Institute (CDRI), Lucknow, an eminent neuropharmacologist. Several eminent scientists representing basic and clinical neurosciences, including those from CSIR institutions (IICB, Calcutta, ITRC, Lucknow, and CDRI, Lucknow) attended the conference and presented their work. While delivering the Presidential address, Dr R. C. Srimal, Director, ITRC, Lucknow, highlighted the need for close collaboration between basic and clinical neuroscientists in dealing with neurological, neurotoxicological and neuropsychiatric problems. He said that rapid advances are occurring in the field of neurosciences making possible the study of neurotransmitters and their receptors in the live brain and targeting of drugs into brain which were not possible so far. The academy awarded Tulsa Bai Somani Educational Trust Award and D.M. Kar Prize for best oral presentations and Prof S.S Parmar Foundation Prize for best Poster presentation to

young neuroscientists. The academy felicitated Prof. B.K. Bachhawat, Bhatnagar Fellow, and an eminent scientist, who had made valuable contributions to neurochemistry and initiated this discipline at CMC Vellore which has developed into an excellent centre for neurochemistry. The academy elected its new Executive Committee with Prof. B.K. Bachhawat as its President. □

Cell Biology

THE XVIII Annual conference of the Indian Society of Cell Biology along with Symposia in Cell Biology and allied areas was organized by National Botanical Research Institute, Lucknow, on behalf of the Society from 13 to 15 February, 1995. The conference was inaugurated by Dr. C.R. Bhatia, FNA, Secretary, Department of Biotechnology, New Delhi, and was presided over by Prof. B.K. Bachhawat, Bhatnagar Fellow, Department of Biochemistry, University of Delhi, South Campus, Delhi. More than 200 young and distinguished

scientists participated in the conference and symposia. Several scientific departments, organizations and private companies, including the Council of Scientific & Industrial Research, Department of Biotechnology, Department of Atomic Energy, Indian National Scientific Academy, etc., co-sponsored the conference and symposia.

In his welcome address, Dr. P.V. Sane, Director, NBRI, elaborated on the genesis of this important annual event of Indian Society of Cell Biology. In his inaugural address Dr. Bhatia gave a detailed account of human benefits and market avenues which could result from the knowledge of cell biology. He discussed several aspects of cell biology — transgenic plants and animals; human globulin gene; artificial blood from transgenic pig with human gene; microbial plants and animal cells. Delivering his Presidential address, Prof. Bachhawat applauded the phenomenal curiosity among the young about cell biology. He suggested how they could pursue a research career in this field within the available infrastructure in the country. Dr. M.R. Das, President, Indian Society of Cell Biology, said that the society was a confluence of scientists from different disciplines, e.g., biophysics, cell biology, cell organelle, molecular biology, etc.

The main aim of the symposia was to focus on the fundamental and applied aspects of cell structure and its functions, in particular on molecular genetic analysis of cellular functions and their applications in agriculture, industry and health.

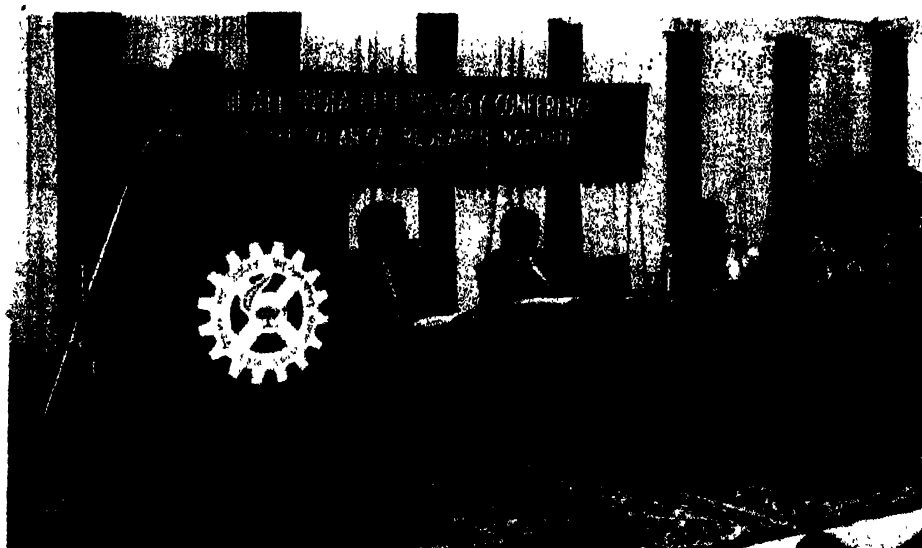
The technical programme was divided into ten scientific sessions, namely, Cell Biology Applications, Prokaryotic Genomes-Recombination and Gene Expression, Plant Molecular Biology, Pathogen/Cell

Training Center for Women

THE Leather Goods Training Centre for Women at Kundrakudi was the joint initiative of CLRI Madras, CECRI, Karaikudi, Village Planning Forum Kundrakudi and NLDP-UNDP. Thavathiru Kundrakudi Adigalar (VPF) has sponsored the above Leather Good Training Centre exclusively for rural women. The training centre was established in 1993. All the technical knowhow needed for conducting the training programme has been provided by CLRI. CLRI not only trains the women but also periodically monitors the training programme.

CLRI on its own and also through NLDP has supplied equipment and sewing machines required for the training centre. VPF has provided land, building and furniture. CECRI has taken the responsibilities of overseeing the training centre through VPF.

The first batch consisting of 10 rural women has successfully completed the training programme in 'Leather goods manufacture'. The valedictory and certificate distribution function was held at Kundrakudi on 22 January, 1995. Dr K.V. Raghavan, Director, CLRI, graced the occasion and distributed the certificates to the women trainees. □



Dr C.R. Bhatia, the Chief Guest, delivering the inaugural address at the All India Cell Biology Conference. Seated on the dais (from left) are Dr R. Tuli, Dr M.R. Das, Prof. B.K. Bachhawat and Dr P.V. Sane

Pathology, Genome Structure and Expression, Plant Biotechnology, Nucleic Acid metabolism and Mutagenesis, Genomic Duplication and Cellular Signalling and Transport.

Dr. Lalji Singh of CCMB, Hyderabad, delivered the 4th Prof. S.P. Raychowdhari 75th Birthday Endowment Lecture. The lecture traced his initial research work under Prof. S.P. Raychowdhari at the Zoology Department of the Banaras Hindu University on sex chromosomes in different snakes, which has now led to the identification and cloning of testes-organizing genes in vertebrates.

Besides, posters were presented mostly by student participants, who came from all parts of the country. These covered diverse areas in cell biology, e.g., cytogenetics, cell structure and function, molecular and development genetics, effects of various chemicals (drugs, pesticides, etc.) on cellular processes, etc. □

Ecofriendly Technologies for Leather Industry

THE 30th Leather Research-Industry Get-Together (LERIG) was held during 28-30 January 1995 at CLRI, Madras. The focus of the meet was on the techno-economics of the ecofriendly projects at Indian sites with international and national funding. "Eco-sustainable Leather Tech-

nologies" was therefore the theme of the meet.

The LERIG is a major annual event in the leather calendar of India and serves as an important forum for exchange of information on the latest technologies for the leather sector. A rapid expansion of the tanning sector is on the cards in India. It is therefore imperative that due emphasis is given to the eco-sustainable technologies particularly in areas where pollution is a major factor threatening the sustainability of the tanning sector. Lasting solutions to the environmental problems of the Indian tanning sector can be sought through a strong industry-research interface and financial support from national and international agencies. To achieve these objectives, CLRI had approached several international agencies for setting up field level demonstration projects on ecofriendly processing in tanneries. The following programmes have achieved significant success : (i) CLRI-TNO programme to set up pilot projects to demonstrate chrome and wastewater management in association with TNO - Delft; Eindhoven, Aplehorn; Agricultural University, Wageningen, BLC, UK; RRL, Trivandrum; CSMCRI, Bhavnagar, and the local



30th Leather Research Industry Get-together held at C.L.R.I., Madras

Exhibition

Building Materials for Low Cost Housing

IN collaboration with the Regional Centre of Central Building Research Institute, Bhopal, the C.S.I.R. Polytechnology Transfer Centre, Bhopal, organized an exhibition on 'Building Materials and Low Cost Housing' at Polytechnology Transfer Centre, Bhopal on 23 February, 1995.

The exhibition was inaugurated by Shri A.K. Jain, Deputy Housing Commissioner, Madhya Pradesh Housing Board. Shri Jain appreciated the technologies developed by C.B.R.I., Roorkee, and said that he himself has successfully utilized these technologies in the construction of Navodaya Vidyalayas. Earlier Shri M.S. Viridi, Project Officer, welcomed the guests who had come from various housing agencies, architectural firms, engineering colleges/polytechnics and individuals planning to construct low cost houses in view of soaring cost of building materials. Shri S.G. Dave, Scientist-in-charge, C.B.R.I. Centre, Bhopal, proposed a vote of thanks. Products of other C.S.I.R. laboratories engaged in the development of building materials were also exhibited. □



Shri A.K. Jain, Deputy Commissioner, M.P. Housing Board, inaugurating the exhibition on 'Building Materials for Low cost Housing' held at Bhopal



Shri S.G. Dave, Scientist Incharge, C.B.R.I. Center, Bhopal, showing the exhibits to guests

leather and allied industries. (ii) UNIDO-SWISS programme to set up field level demonstration plants at Pallavaram, Ranipet and Pernambut in Tamil Nadu for common and individual effluent treatment and ecofriendly technologies. The Indian agencies collaborating in

the programme are Tamil Nadu Pollution Control Board (TNPCB), CLRI and the Tamil Nadu Leather Development Corporation (TALCO).

The LERIG-95 focussed on information dissemination on the technoeconomics of the success-

fully completed projects pertaining to the above international programmes. It provided an excellent opportunity to the tanners and their technical experts to obtain first hand information on the following field tested technologies, viz., chrome management; com-

mon chrome recovery/reuse; ammonia free and cleaner wet tanning; mechanical desalting; less sulphide liming; effluent treatment for chrome and vegetable tanned leather; and common effluent treatment for a city tannery cluster.

International experts from the UK, The Netherlands, Austria, Switzerland and other countries participated in the technical sessions. The demonstration projects set up at various locations in Tamil Nadu were visited by the interested tanners.

The B. M. Das Lecture delivered by Dr. Ron E Whittaker, Chief Executive, SATRA, UK, was on "Quality and Ecofriendly Standards for Footwear". A special interaction session with the leather industry was organized to discuss the various issues related to the international ecolabeling of leather/products and the recent German ban on benzidine/arylamine based dyes and other formulations. The other attractions of LERIG-95 were industrial visits, demonstration of ecofriendly chemicals/processes and poster presentations of recent research developments. □

Lectures

Second Rajiv Gandhi S&T Lecture

THE Second Rajiv Gandhi Science & Technology Lecture on "Life Under the Sun" was delivered by Prof. Lord Porter, OM, FRS, under the auspices of the Rajiv Gandhi Institute for Contemporary Studies at NCL, Pune, on 9 January 1995. Smt. Sonia Gandhi Chairperson, Rajiv Gandhi Foundation, presided over the function. Prof. Porter, a Nobel Laureate, is presently the Chairman, Centre for Photomolecular Sciences, Imperial College, London.

Dr R.A. Mashelkar welcomed the guests. Prof. C.N.R. Rao, President, Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore, introduced the function. After a brief address by Smt. Sonia Gandhi, in which she recalled Rajiv Gandhi's commitment to India's progress through scientific advancement, Prof. Porter delivered his address on "Life Under the Sun". He said that by burning fossil fuels in immense quantities to meet his energy needs the man is releasing the carbon that has been extracted over three and a half billion years from the atmosphere back into it in one generation, with the consequent harmful effects! The only way to solve this problem is to use the abundantly available solar energy by imitating nature. □

Celebration of An Experiment

THE 1995 NAL Science Day Lecture was delivered by Prof. Ramnath Cowsik, Director, Indian Institute of Astrophysics, on 28

February. The title of the lecture was 'Einstein's equivalence principle and new forces of nature'.

In the lecture Prof Cowsik recounted the details of what is already being recognized as one of the great experiments in Indian physics in recent times. The 'Cowsik (TIFR) experiment' is an attempt to study the forces in nature. Gravitational, electromagnetic, weak and nuclear forces are well known. Could there be other unknown forces? What kind of an experimental setup would be needed to probe such questions? Prof Cowsik's lecture eventually went on to discuss these issues starting with a description of the Cavendish balance of 1797. While Cavendish and practically everyone else used spheres, the Cowsik-TIFR team uses a lead and copper ring to study gravitational forces. The experiment is yielding results of surprisingly high accuracies without requiring sophisticated technologies and electronics.



Dr K.S. Yajnik, Head, C-MMACS, N.A.L., introducing Prof. Ramnath Cowsik (seated) to the audience. Prof. Cowsik delivered the 1995 NAL Science Day Lecture on 28 February 1995

At another level, therefore, Prof Cowsik's lecture was a tribute to the Indian experiment and was an assertion that it is still possible to carry out ingenious or devilishly clever experiments in India in spite of our severe technological shortcomings. That's what C.V. Raman first showed 70 years ago— isn't it? That's why every year the discovery of the Raman Effect is celebrated on 28 February, the National Science Day.

The hour-long lecture began with a warm welcome to Prof Ramnath Cowsik by NAL Acting Director Dr B.R. Somashekar and an introduction of the distinguished speaker by Dr K.S. Yajnik. He said that Prof Cowsik's education was "home-bred" and that "although Prof Cowsik's interests tend to be celestial, his feet are firmly planted on the Indian terra firma!" □

Deputations

Baldev Singh

DR Baldev Singh, Scientist, Central Fuel Research Institute, Dhanbad, was deputed to France under the CSIR-CNRS Exchange Programme for a period of two months (October - December 1994). The visit was confined mainly to three laboratories, i.e., Laboratoire Catalyse et Chimie Organique Poitiers Cedex, Laboratoire de Chimie Organique, Montpellier Cedex and Laboratoire de Recherche Sur, Villurbanne Cedex. The purpose of the visit was to acquaint Dr Singh with the latest developments in synthesis and characterization of 'Pillared Inter-layer Clay' under the current programme on C₁-Chemistry being pursued at C.F.R.I. Dr. Singh acquired specific knowledge in the areas of preparation of highly thermo-stable and large surface area pillared clays, influence of pil-

laring agents and effect of acidity on them apart from studying factors affecting their stability and learning the latest instrumental techniques for the characterization of pillared clays. Dr. Singh also acquired an expertise on synthesis of zeolite membranes. □

Honours and Awards

M. K. Basu

DR. Mukul Kumar Basu, Scientist EII, Indian Institute of Chemical Biology, Calcutta, was felicitated by the Science Association of Bengal at a ceremony held at the Nehru Children's Museum, Calcutta, on the occasion of the National Science Day, 28 February 1995. Dr Basu was awarded a plaque and received a citation in recognition of his outstanding contributions in the field of scientific research and development. □

B.L. Parasher and I.R. Arya

ON the occasion of the Platinum Jubilee celebrations and Ninth Indian Engineering Congress of the Institution of Engineers (India), held on 17th December, 1994 at Calcutta, two C.R.R.I scientists, S/Shri B.L. Parasher and I.R. Arya were jointly awarded the Certificate of Merit for 1993-94 by the Institution of Engineers for their paper entitled 'Water Bound Macadam: An Oldest, Simplest and Optimal Road Pavement' published in the Journal of the Institution of Engineers, April 1993. □

R.N. Athavale

DR. R.N. Athavale, Scientist 'G', National Geophysical Research Institute, Hyderabad, has been elected a Fellow of the National Academy of Agricultural Science,

New Delhi. Dr. Athavale has worked as Coordinator of the Indo-German Geohydrological Project and has many publications in the field of water resources. He is currently leader of the project on 'Appraisal and Management of Water resources in problem areas and measurement of natural recharge studies'. □

R&D Flashes

Improved Furnace

CGCRI Khurja centre has developed an improved type of furnace for bulk firing of terracotta images usually made by Bharwalia village artisans of Bhatahat Block of Gorakhpur, U.P. The furnace was made under Deen Dayal Development Scheme at a cost of Rs 13,000. Capacity of the furnace is six times greater than the traditional type of kilns generally used for firing a small number of images at a time and are not durable. In the improved type of furnace, heat is evenly distributed throughout a large area inside the hearth thereby imparting a shining look to the product as well as appreciable strength. The design of the furnace minimizes heat loss so that the maximum amount of heat is utilized for firing. The cost of product is therefore cheaper. The potters and artisans also gain more profit.

The new furnace was commissioned by the Chief Development Officer Shri Jivesh Nandan who said that the Government has recognized terracotta image as 'Yojana Prajapati' under Deen Dayal Development Scheme. Under TRYSEM Scheme more and more people have been imparted training for taking benefit from it. □

N.V. Raman, Director, SERC-Madras lays down office

“I saw SERC born. I grew along with the laboratory. Today the SERC Madras has grown into an organization of International Standards....,” reminisced Director, Shri N.V. Raman, while addressing the scientists and members of staff of Structural Engineering Research Centre, Madras, who had assembled along with their colleagues from the CSIR Madras Complex to bid him goodbye. After an illustrious service of thirty seven years with the CSIR Shri Raman took voluntary retirement on 27 February, 1995. “Shri N.V. Raman has played a major role in envisioning and establishing the new Wind Tunnel facility at SERC, Madras”, said Dr S.K. Joshi, DG, CSIR, who graced the occasion. “I would request Shri N.V. Raman to continue to give the benefit of his rich experience and advice on important matters in future as well when the need arises”, said Dr T.V.S.R. Appa Rao, Acting Director, SERC. in his welcome address at the farewell function. Shri N.V. Raman, born in November 1935, received his education at the University of Mysore and later at the University of Melbourne, Australia, where he secured first rank in the Master of Engineering Science degree. Raman established one of the first computer centres in India in 1964 at Roorkee and gave the lead in introducing the application of computers to solve complex practical problems through matrix methods of structural analysis in the country. To create awareness and motivate the use of computer aided structural analysis techniques in India, he started publication of *Computer Centre Bulletin* in March 1966. Shri Raman headed SERC - Roorkee during 1971-78 at which time he gave



leadership for successful completion of many R & D programmes and directed the lab's interaction with industry for designing complex structures. The design of Council Hall at Bombay, Guru Gobind Singh Bhavan at Patiala, and the re-designing of a 300 m high Television Tower at Bombay, are a few examples. He had the rare distinction of serving as Director on the Board of Directors of National Building Construction Corporation, New Delhi, for almost a decade. He served as United Nations Consultant to Building Research Centre, Baghdad, Iraq, in 1971 and again in 1973.

The state-of-the-art computer graphics laboratory set up in the early 80s at SERC, Madras, was his brainchild. He had developed a highly sophisticated software package for non-linear analysis of Guyed tower and Transmission line towers. He had initiated the development of an Expert System for design of transmission line towers and application of parallel processing techniques for structural engineering problems. Shri Raman took over as the Director of SERC-Madras and Coordinating Director of CSIR Madras Complex, in March 1990. He displayed a unique penchant for looking into

minute details of not only R & D activities but also other related areas such as information dissemination, technology transfer and publications. As the Chairman of the organizing committee for the International Symposium on Fatigue and Fracture in steel and concrete structures (ISFF '91) his meticulous planning was par excellence. As the National Project Director of SERC-UNDP project on 'Engineering of structures for mitigating damage due to cyclones' he was the visionary behind the establishment of a highly sophisticated Boundary Layer Wind Tunnel facility in this part of the world.

Shri Raman's keen sense of aesthetics manifested in planning and establishment of a state-of-the-art library in SERC-Madras with automated library services. Raman was a distinguished member of many scientific societies and academic bodies such as the International Association for Shell and Spatial Structure, Spain; Guiding Committee for National Building Code; Board of Studies for Structural Engineering of Annamalai and Bangalore Universities; etc.

Under Shri N.V. Raman's stewardship the CSIR Madras Complex with seven units for different scientific disciplines were well coordinated, reflecting the rare combination of his talents of deft personnel management, great scientific acumen, and appreciation for other engineering disciplines. □

Raj Mahindra: 1925-1995 A Tribute

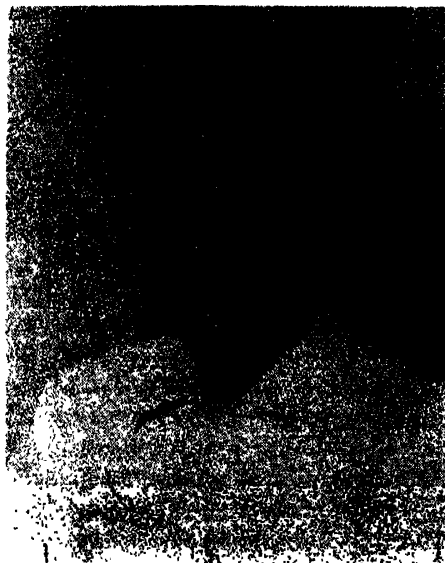
SHRI Raj Mahindra, the renowned aircraft designer, died peacefully in his sleep in the early hours of 16 February 1995 at New Delhi following a massive heart attack. Reproduced below is a tribute paid to him by Dr S.R. Valluri.

"I first met Raj at Satish (Dhawan)'s place about thirty years ago and took an instant liking to him. We all drove in my car to Srirangapatnam and even in the course of that drive I knew that I had found a true friend. Raj went on to become my dearest friend in India.

"Raj was enormously knowledgeable. I can't think of anybody who knew more about aircraft design in India. He seemed to have an instinctive feel for design. He could always spot the most appropriate solution from a set of design alternatives. He was a true master of this art. Several years after I met Raj, I read an article in *New Scientist* describing the ideal attributes of an aircraft designer. It read like a customized sketch of Raj Mahindra!

"There must be hardly any aircraft programme in India not involving Raj. At HAL whether the responsibility involved design or production, Raj always saw it through with utmost commit-

ment and a certain degree of perfection. His most important contribution to Indian aviation — or certainly the one which gave him the greatest pleasure — was the HJT-16 (*Kiran*) aircraft. Raj tackled the innumerable problems of prototype development of *Kiran*



and later of its production and introduction into IAF squadrons. But perhaps we should remember Raj even more for his contributions to the LCA (Light Combat Aircraft) programme. He was the principal architect and conceptualizer of the LCA design. I also cannot forget the aplomb and confidence with which Raj tackled foreign aircraft designers and his tremendous dedication to India's national interest. One of these days when the LCA finally

flies the country should not fail to record its gratitude to Raj. I consider Raj's departure from the LCA programme to be an extraordinary national loss. He was the only person in the country capable of seeing an aircraft through all its development stages.

"Look at Raj's track record. After graduating from Punjab University in Lahore, Raj was in the Imperial College of Science and Technology at London working for his DIC under Sir Arnold Hall. When the British aircraft company De Havilland asked Sir Arnold to recommend an aircraft designer he said, "I can think of no one better than that boy Raj". Sir Arnold advised Raj to give up formal studies and take up the intricate task of aircraft design instead. Raj worked for several British aircraft companies right through the 1950's till Kurt Tank and HAL picked him for the HF-24 team in 1959. And even at HAL he was in the thick of aircraft design till his retirement as MD (DD) in 1983!

"Subsequently, Raj plunged himself into a new odyssey: of making countless studies of aircraft which could one day be built in the country. One such study which caught Dhawan's attention as Chairman of NAL's Research Council was the LCA. Raj worked tirelessly for the LCA and, indeed, even gave his life for the airplane". □

Amplifier for Electromagnetic Actuator

The Central Electronics Engineering Research Institute (CEERI), Pilani, has developed a

pulse width modulated amplifier and control electronics for position control of an electromagnetic actuator for the Aeronautical Development Establishment.

A permanent magnet dc motor and multistage gear train are used

to move the output shaft to a desired position. Controlled movement of the motor is achieved by PWM amplifier and control circuit. Main advantage of PWM amplifier is compact size of the actuator electronics.

Broad System Specifications:

Input voltage	:	28 V dc nominal
current	:	15 A peak
Output voltage	:	1 to 26 V dc at nominal input
current	:	15 A peak
Position input	:	+/- 20 degrees
Stall torque	:	4 kg. m
Stiffness	:	3.6 kg. m/degree
Bandwidth	:	6.4 Hz (-3 db)
Position accuracy	:	5% of the command input or
	:	0.2 degree (whichever is greater)
Size (electronics)	:	60*60*75 mm

Environmental Specifications

Storage	:	-50 to +85°C
Operating	:	-40 to +70 °C
Vibration	:	0.04 g ² /Hz
	:	20 Hz to 2 KHz
Shock	:	30 g for 11 msec
Humidity	:	95% RH at 40 °C
Acceleration	:	+/- 15 g in all three axis □

Automatic Irrigation System

SOIL moisture is one of the most important parameters in agriculture. While too little water damages the plant, excess of it dissolves the nutrients and micro-nutrients

and takes them to the depths not accessible by the roots, resulting in soil infertility and poor yield. The sprinkler and drip irrigation methods save considerable amount of water. But in both methods water is supplied to the plant in an arbitrary manner. No continuous soil moisture measurement is done in the field to estimate whether it is sufficient for the plant or not.

The Central Electronics Engineering Research Institute (CEERI), Pilani, with financial input from the Department of Electronics has developed a Micro-controller based Automatic Drip Irrigation System to cater to the requirements of farmers as well as researchers. The field trial is being conducted at Vasantdada Sugar Institute, Pune. This instrument not only continuously monitors the soil moisture but also maintains it within the desired pre-set limits.

Design philosophy

To sense the soil moisture quickly and economically, special low-cost sensors were developed. These probes can be produced in large numbers by a simple process. An associated electronic circuit provides a dc output to an analog to digital converter (ADC) to convert the moisture level into digital form which is then processed by a micro-controller. The microcontroller actuates a stepper motor to open or close a valve in the main pipe line. In this way the moisture in the soil is continuously monitored and controlled.

Salient features

Fully Automatic

Continuous unattended operation round the clock, round the year.

Operates on Different Power Inputs

Operates on ac mains, battery or solar cell charged battery. It has a built-in battery charger which charges the battery by boost charge while in discharged condition, and changes over to trickle charge when the battery is fully charged. Also, it has an uninterruptible power supply which automatically and instantaneously changes over from main to battery and vice versa by electronic switching.

Automatic Overhead Tank Filling

Monitors the overhead tank water level and starts the pump set when the water level is low. When the tank is full, the pump motor is automatically switched off.

Modular Construction

Because of modular construction, different combinations are possible. The same system can be used to control either a single field, a couple of fields or four fields in a sequential manner, expandable up to eight fields by adding more modules.

Manual Over-ride

Provision is made to open or close the valve in case of emergency remotely from the control console itself by manual over-ride disabling after automatic control.

User Friendly

The system is so automatic that the user is not required to do anything after the initial installation.

Versatile

This unit can be added to any type of irrigation system like sprinkler or drip system.

Security

The automatic control software is fully protected from piracy, and cannot be copied. □

Composite Door Shutter

ALTHOUGH it is not easy to develop man-made material which could replace wood in all respects, viz., warmth, aesthetics, textural and colour variety and structural qualities, there is a dire need to replace timber by suitable substitutes in building industry. Door shutters and windows are one of the important and essential requirements of a building and consume about 60-70 per cent of the total wood consumed in buildings. A new material named 'EPS Composite' has been developed at the Central Building Research Institute (CBRI), Roorkee, to replace wooden door shutters and panelling.

EPS composite is a sandwich type composite consisting of modified medium density fibre sheets as facing material, medium density fibre sheet or rubber wood as framing material, and self-extinguishing grade expanded polystyrene sheet, or sheet developed by expanded polystyrene beads bonded with cashew nut shell liquid polymer, as core material. The core along with the facing and

framing material is bonded with the help of an adhesive developed at the Institute.

The resultant EPS Composite door shutter is a perfect substitute for wooden door shutter. It presents a perfect base material for painting, lacquering, lamination and veneering. The door can be drilled, routed, planed and machined without splitting, splintering or chipping with conventional equipment used in carpentry shops.

Sandwich composites are a special form of laminated composite in which thin, strong, stiff, hard but relatively heavy facings are combined with relatively soft, light and weaker cores to provide a lightweight composite. The composite is much stronger, stiffer than the sum of the individual stiffness and strength of the cores. Sandwich panels with foam core have shown greater promise in construction activity and have helped architects and engineers the world over to evolve new design techniques. Demand for housing

is rising concurrently with the increase in population and about 2.18 crores dwelling units would be required in the Government sector alone in the present five year plan. The new material is an alternative to wooden door shutters. Even partial replacement of wood will help in saving the meagre forest resources of the country.

EPS Composite door shutters have been tested in the laboratory and have passed all the required tests. □

US firm to market NAL technologies

THE Memorandum of Understanding signed by National Aerospace Laboratories, Bangalore, (NAL), and Manhattan Business Consulting (MBC), USA, on 31 January 1995 is surely a pointer to the shape of things to come. It has long been recognized that NAL has the "knowledgebase" (technologies, expertise, services) which can be marketed internationally. The real difficulty has been to identify and eventually develop these markets. The MoU signed by Mrs Saroja Rajagopal, COA, NAL, and Dr Dillip B. Adarkar, Principal, MBC, stating that "CSIR/NAL are entering into an understanding to develop new markets for NAL capabilities in USA" therefore constitutes a sincere effort by NAL to overcome its marketing handicaps.

On the occasion of signing the MoU, Dr B. R. Somashekar, Acting Director, confessed that marketing was not one of NAL's strong points. "That's why I am especially delighted to sign this MoU with Dr Adarkar who has successfully sold aircraft and associated components worth 350 million US \$ for Douglas," he said. □



Edge details of EPS Composite panels

Printed and Published by Dr G.P. Phondke, Director, Publications & Information Directorate (PID), Dr K.S. Krishnan Marg, New Delhi - 110 012
Printed at PID Printing Unit

Editors : Dr B.C. Kashyap, Dilip M. Salvi and Madhu Sahni

Production : Kaushal Kishore

Annual Subscription : Rs. 80
Single Copy: Rs. 3.00

Phone: 5786301

Gram: PUBLIFORM

Telex: 031-77271

E-mail: pid@simetl.comet.in.

Fax: 5787062

RN 4512/57

CSIR

NEWS



VOL 45 NO 9 15 MAY 1995



IN THIS ISSUE

Life Safety Device and Eco-friendly Bin	130	Central Building Research Institute, Roorkee	
New Plant Varieties released	132	R&D Highlights: 1992-94	133
Electrochemistry in Aerospace Technology	139	National Science Day Celebrations	140

Fire explosive studies in progress at Central Building Research Institute, Roorkee (left)
Eco-friendly garbage bin/loader developed by Central Mining Research Institute, Dhanbad (right)

Life Safety Device and Eco-friendly Bin

LIFE safety device for two wheelers and Eco-friendly bin developed by the Nagpur Regional Centre of Central Mining Research Institute, Dhanbad, were demonstrated before the media persons at the CSIR Science Centre, Lodhi

Gardens, New Delhi, on 10 March 1995. Around forty persons representing major newspapers, Delhi Doordarshan, All India Radio, etc., witnessed the live demonstration. Prof. S.K. Joshi, Director General, CSIR, and Prof. B.B. Dhar, Direc-

tor, CMRI, were also present on the occasion.

Shri B.K. Jha, who had designed the Life Safety Device, himself rode the scooter fitted with the device to show its effectiveness. The scooter moving at a speed of 40 km/h was made to collide against a barricade made of 10 cm thick sal wood. The wood broke into pieces but no damage was done to the scooter or its rider.

Similarly, the functioning of the garbage bin/loader was demonstrated by transferring garbage from the bin to a truck. The credit for developing this device also goes to Shri Jha.

Both the demonstrations were cheered by all present. Prof. Joshi congratulated Prof. Dhar, Shri Jha, Dr J.L. Jethwa, Scientist in Charge, CMRI, Nagpur Regional Centre and all others responsible for the development of these devices. These were covered by major newspapers, Delhi Doordarshan and All India Radio.

Life Safety Device

The device essentially consists of a metallic dash shield connected to two shock-absorbers fixed on the front panel of the two-wheeler, an ignition cut-off switch and two-wheel mounted emergency stand. In the event of an accident the device: (i) reduces impact of the collision; (ii) automatically cuts off ignition which stops the running of engine; and (iii) prevents over-turning of the vehicle as the emergency stand automatically comes into position. The device thus reduces chances of injury to the rider and damage to the two-wheeler. It can be mounted on any two-wheeler,



Demonstration of Eco-friendly Garbage Bin/Loader in progress



Life Safety Device for a two wheeler

including scooters, mopeds and motorcycles and costs around Rs 1000. Keeping in view that the number of accidents involving two-wheelers is around 60,000 per year (of which around 10,000 are fatal and another 20,000 lead to permanent disability) in the country, this device is expected to find a great demand among the two-wheeler manufacturers/users.

Eco-friendly Garbage Bin/Loader

It is a wheel-mounted mobile mechanical system which stores, transports and dumps garbage onto a truck, through 'screw and pulley' mechanism. One does not have to touch the garbage while transferring it to the truck. The system: (i) provides covered storage of garbage to prevent its pilferage; (ii) moves on tyre mounted wheels and eliminates garbage transportation as head-load; (iii) has an easy mechanical arrangement for quick and automatic loading of garbage onto trucks; (iv) is a cheaper and effective alternative to the compactor system; (v) can be placed at any location because of its size; and (vi) is usable by individual units like hotels, multi-storeyed complexes, hospitals, etc., to supplement the efforts of municipal bodies.

A comparison of the garbage loader-truck combination with manual loading system on trucks used by Nagpur Municipal Corporation showed that approximately 600 tonnes of garbage can be handled by 80 labourers using the loader as compared to 400 tonnes of garbage by 240 labourers with the existing Nagpur Municipal Corporation practice. The number of trucks used in both the cases was 40. The comparison thus brings out the following advantages of the loader: (i) higher efficiency to the extent of 50%; (ii) saving of man-days to the extent of 150 ± 10 ; (iii) elimination of unhygienic atmos-

phere and social stigma of garbage transportation as head-load; and (iv) possibility of re-deployment of workers to improve the corporation's efficiency.

The loader can be used as an inhouse facility both in government and private establishments like hospitals, schools, small scale and cottage industries welfare agencies, community development agencies, multi-storeyed residential units, entertainment places, eating places, marriage halls, religious places, etc. It can augment the corporation efforts to maintain clean cities and towns.

For further information write to: Director, Central Mining Research Institute, Barwa Road, Dhanbad 826 001, or Scientist-in-Charge CMRI Regional Centre, 54-B, Shankar Nagar, Nagpur 440 010. □

R & D Flashes

China Clay Waste in Ceramic Products

CERAMIC raw materials traditionally available in India are of superior grade and they are profitably employed for the manufacture of high quality ceramic products. The use of these high grade materials for the manufacture of low-grade industrial ceramic products like tower packing materials and low tension insulators is not only a waste of this valuable resource but also leads to depletion of natural wealth which can otherwise be meaningfully utilized for the manu-

facture of high grade costly materials. An urgent need is therefore felt to look for the possibilities of utilizing low grade ceramic materials so that the existing reserves of good quality ceramic raw materials can be used for other products that demand superior quality.

It is against this background that the Central Glass & Ceramic Research Institute, Naroda Centre, took up a project in 1993 with financial support from M/s Shri Ram Mine-Chem International, Madhapar, Kachchh district, Gujarat, to develop low cost industrial ceramic products, namely, tower packing materials and low tension insulators, that incorporate china clay waste. During beneficiation of china clays from crude ores, a huge quantity (about 70-80%) of waste is obtained from china clay washeries which creates problems for disposal to the concerned industries. This waste material has not been used so far for any useful purpose and thus remained unexploited for a long time. Thorough study of the physicochemical and mineralogical properties of the waste and utilization of



Tower packing material (top) and Low tension insulator (Bottom) incorporating china clay waste developed at CGCRI Naroda Centre

New Plant Varieties released

Peppermint

PEPPERMINT (*Mentha piperita*) is of special interest because of its high value as an essential oil crop. The United States is the world's largest producer of peppermint oil accounting for about 90 % of the world's total production of about 3500 tons. In India, the annual production of peppermint oil is estimated to be about 100 tons valued at rupees two crores which is consumed in the domestic market. A small quantity of peppermint oil is still imported to meet the internal demand. The major constituents of oil in both peppermint and Japanese mint (*M. arvensis*) are menthol, menthone and menthyl acetate and yet the odours of these two oils differ because of the other minor constituents present. The oil of peppermint has a delicate flavour not obtainable from other mint oils and is used mainly for flavouring pharmaceutical preparations and confectionary.

The variety *Kukrail* was developed at Central Institute of Medicinal and Aromatic Plants, Lucknow, by mutation breeding from vegetatively propagated local strain. The new cultivar is similar to its parental clone in morphological features except it is more erect, with vigorous growth. Field evaluation trials conducted at Lucknow and Pantnagar have shown the cultivar *Kukrail* to be significantly superior to the local strain by yielding 3 % and 19 % more oil at Lucknow and Pantnagar, respectively. However, the oil quality profile was similar to that of its parental local strain.

Japanese Mint

JAPANESE mint oil obtained from distillation of *Mentha arvensis* herb is one of the most

important essential oils. Its annual world production is about 10,000 tons amounting to about Rs 3000 million. The oil is a rich source of 1-menthol which is used in pharmaceutical, flavour and cosmetic industries. Moreover, dementholysed Japanese mint oil is used to reconstitute *M. piperita* oil. India produces about 5000 tons of oil, and 2500 tons of natural amenthol derived from the oil.

To augment its widely cultivated variety HY-77, Central Institute of Medicinal and Aromatic Plants, Lucknow, has now developed another improved variety called *Gomti* (MaH-9). A derivative of the variety *Shivalik*, *Gomti* is tall with reddish thick stem, broad dark green leaves, vigorous in growth and late maturing. Pilot scale trials were conducted at Lucknow and Pantnagar.

The new cultivar *Gomti* proved superior to both HY-77 and *Shivalik* at Lucknow and to HY-77 at Pantnagar. It gave 18 % and 32 % more oil yield over HY-77 and *Shivalik* at Lucknow and 40 % more oil yield over HY-77 at Pantnagar. The oil quality of *Gomti* (menthol 80.2 %, menthone 4.2 %, menthyl acetate 1.7%) is similar to that of HY-77 but superior to that of *Shivalik*.

Pyrethrum

PYRETHRUM, (*Chrysanthemum cinerariaefolium*) is cultivated for its flowers which contain pyrethrins — the important ingredients of natural insecticide. Pyrethrins, a mixture of six related esters (three derived from chrysanthemic acid, pyrethrins I and others from pyrethric acid, pyrethrins II), have a long history of safety, virtually non-toxic to human and other warm blooded animals, and effectiveness on ac-

count of high toxicity to a wide range of insect species.

A large number of pyrethrum clones from open pollinated populations maintained at various farms in Kashmir were screened for productivity and quality during 1979 to 1981. Ten best clones were polycrossed and evaluated during 1981-82 and 1982-83. The cultivar *Jhelum* (clone CL-7) with vigorous growth habit, medium height (95-105 cm), high number of flowers per plant (290-350), and high pyrethrins content (1.5%) performed best of all the 85 better clones selected from polycross during 1983-84. It also out-yielded others over the years during various trials conducted by scientists of Central Institute of Medicinal and Aromatic Plants, Lucknow.

German Chamomile

GERMAN chamomile (*Matricaria chamomilla*) is an old introduction to India. Essential oil extracted from its flowers, known as blue oil in commerce, fetches a very high price (Rs 20,000 to 40,000/kg) in the market. *Vallary* is the strain M70-1, an induced mutant. Its performance during pilot scale trials conducted at Central Institute of Medicinal and Aromatic Plants, Lucknow, showed improvement.

The cultivar *Vallary* yields 63% and 20 % more dry flowers and oil respectively over the available check varieties. The oil of *Vallary* has deep blue colour, indicating higher proportion of chamazulene, the anti-inflammatory compound in it. *Vallary* is now released for commercial cultivation in India. The *Vallary* plants are tolerant to high pH of the soil and can be safely grown in alkaline/saline soils. □

this material in appropriate quantities for development and manufacture of tower packing materials and low tension insulators was carried out. It was found that the china clay waste having poor plasticity due to the presence of about 45.5% grit material over 325 mesh possessed low dry linear shrinkage and low unfired strength which necessitated upgradation of the materials to a desired quality by suitably blending it with good quality plastic clays for satisfactory formulation of traditional ceramic products. The X-ray diffraction study revealed that the china clay waste contained kaolinite and quartz as the major materials and anatase as a minor one. This waste material has been

utilized upto 50 wt % in the production of tower packing materials along with plastic clays like Bikaner ball clay, fire clay and potash feldspar. Similarly, the material developed for low-tension insulator also contained china clay waste in the range of 40 to 45 wt %.

The products developed possess all the important properties and also conform to the specifications of the Bureau of Indian Standards. The tower packing materials in various shapes and sizes, namely, saddles, raschig rings, partition rings, honey combs, etc., are impervious and resistant to acids, alkalies and other chemicals and so will find wide applications in petrochemicals, chemical and fertiliser industries for providing

increased non-absorbant and non-corrosive surfaces to enhance the rate of chemical reactions. Similarly, the low-tension insulators in shapes like kit-kat fuses, fuse bases, and in other products of different designs depending on the electrical loads will also find wide applications in household electrification, state electricity boards, railways, telephone industry, etc.

The technology was transferred to the sponsor through a Training-cum-Demonstration Programme held at CGCRI, Naroda centre, in Ahmedabad. The technology is economically viable as it utilizes an industrial waste (upto 50 wt per cent of the total batch) in the production of such products which have tremendous market potential. □

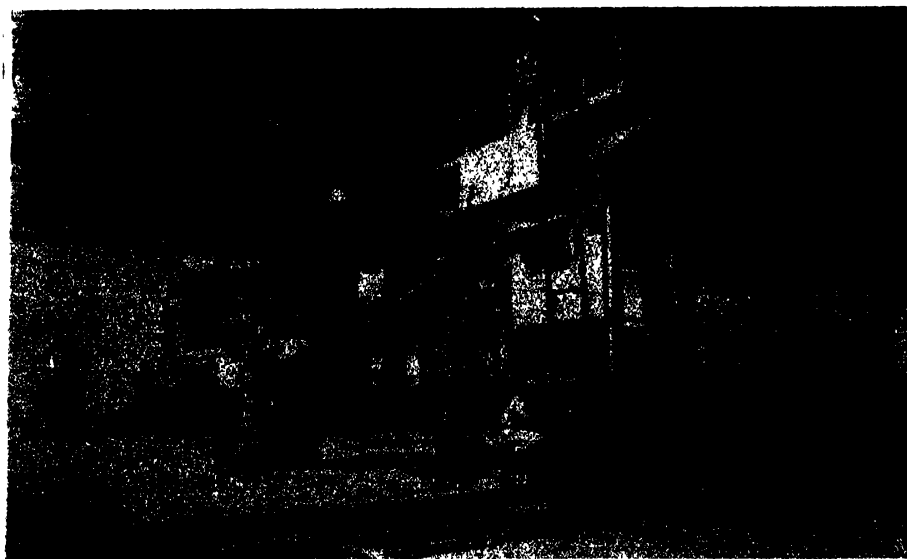
Central Building Research Institute, Roorkee

R & D Highlights : 1992-94

THE Central Building Research Institute (CBRI), Roorkee, continued to pursue its R&D activities in the areas of architecture and physical planning, building material, building processes, plant and productivity, education and health care building, structures, disaster mitigation, building physics, geotechnical engineering and rural housing. The main thrust was on the development of new building materials from industrial and agricultural wastes. The Government of India has also given top priority for the development of wood substitutes in order to save the fast depleting forests. The institute has done commendable work in this direction too. The development of ferrocement door shutters, plastic composite panels for door shutters, EPS door shutters and Coir-CNSL board are good substitutes for timber. These materials have great potential for commercially replacing a large percentage of timber being used in the construction

activity. A polyurethane based water proofing compound developed in collaboration with the National Chemical Laboratory, Pune, has been successfully launched in the market as Beck-Bond PU by Dr Beck & Company India Ltd.

Commercial production of clay flyash bricks by M/s Grasim India Ltd at Nagda (M.P.) and M/s Essar Projects Ltd, Baroda (Gujarat), with CBRI technologies has successfully commenced. The plants are producing 30,000 to 40,000



Overall view of flyash sand lime brick plant at Durgapur



Firing of bricks manufactured at Nagda

bricks per day and the quality of the bricks as reported by these firms very good. A mechanised plant for the production of 40,000 flyash sand lime bricks per day has been commissioned in collaboration with the Damodar Valley Corporation, Calcutta. Feasibility reports for the utilization of flyash from GGS Thermal Power Plant, Ropar, and GND Thermal Plant, Bhatinda, for making bricks from the available soil in the vicinity were prepared and submitted to Punjab State Electricity Board.

The institute has been retained by the Central Pollution Control Board (CPCB), Delhi, for the preparation of a comprehensive industry document and National Emission Standards for brick kilns. The institute is also a participating laboratory in the CSIR Thrust Area Programme on the development of Indian reference materials. Steel Authority of India, Indian Oil Corporation, National Institute of Nutrition are collaborating in this endeavour. Keeping in view the fact that Government of India has

phased out the use of existing highly toxic chlorinated hydrocarbons, the work on the development of eco-friendly pesticides for anti-termite soil treatment has been appreciated by the Ministry of Environment. Based on the work carried out at the institute, the Central Insecticide Board, Government of India and Bureau of Indian Standards have recommended the use of non-toxic chlorpyrifos.

The Mini Climbing Crane, designed and developed at the institute, won the NRDC 1994 Republic Day Award. About seven firms in different parts of the country have been given licence to manufacture the crane.

On the request of U.P. and Maharashtra Governments, technical guidance and design for earthquake resistant dwellings for the rehabilitation programme in Latur and Uttarkashi regions were also provided. Many training programmes for local artisans were also arranged. A number of alternative plans for houses for cyclone prone areas have been developed to meet the spatial requirements of the inhabitants.

The institute as a Nodel Agency for planning and designing of Navodaya Vidyalaya Complexes throughout the length and breadth of the country has played a vital role. Based on the design guidelines provided by the institute, 200 vidyalayas were completed and construction work on another 120 different sites is in progress. Space norms for EWS and LIG house-

holds in the metropolitan cities have been also formulated.

Landslide hazard zonation maps and various multipurpose terrain evaluation maps of three sectors of Bhagirathi Valley, viz, Rishikesh-Gangotri, Rishikesh-Devprayag and Rishikesh-Uttarkashi covering about 3000 sq. km. area have been prepared. The incidence of landslides as a consequence of developmental activities can be much reduced if these maps are used by the user agencies during planning stages. The methodology developed at the institute has been used for the preparation of land slide hazard zonation maps through synthesis of various geo-environmental factors influencing the stability of East Sikkim Himalaya covering about 6.10 sq km area.

The project sponsored by Indian Airlines for making fire protection cover for aircraft seat cushion has been successfully completed. The final product called Fire Blocking Layer (FBL) was evaluated and approved by SGS, London, and Civil Aviation Authority of India. As a result of extension activities, CBRI's construction techniques were used in more than 50,000 buildings in rural and urban areas. Over 18,000 residential and industrial commercial buildings were completed by various organizations such as AP State Housing Corporation, MHADA, Rajasthan Housing Board, Gujarat Housing Board, MP Housing Board, NTPC, etc.

The cash inflow through consultancy, sponsored projects and testing was Rs 150.13 lakhs (1992-93, EBR 31.8%) and Rs. 139.40 lakhs (1993-94, EBR 26.3%).

Low cost/Alternative Building Materials & Components

Slag Lime Bricks: Investigations were undertaken on the prospects of development of bricks using granulated blast furnace slag - an industrial waste obtained during the manufacture of iron and steel. Laboratory results revealed that good quality bricks can be produced by pressing a mixture of granulated slag 30-50%, sand 40-60% along with 5-10% of lime at sufficiently low pressure of 5 MPa and moist curing at room temperature. The production of such bricks does not require firing or autoclaving for strength development and thus helps in saving energy and also reduces pressure on agricultural land. The bricks of density 1800-2000 kg/m³ compressive strength 100-150 kg/cm² and 16-18% water absorption have been produced. The cost of production of slag lime bricks will be cheaper as compared to burnt clay bricks if manufactured in the vicinity of iron and steel industry.

Saving Coal in Brick Kilns:

Coal is the main fuel employed for firing of bricks in commercial Bull's Trench Kilns. Diminishing reserve of coal and exorbitant cost of transportation from coal mine to kiln site causes high cost of production of bricks.

Adapting modified setting pattern of bricks and improved burning techniques in kilns it has been possible to save coal up to 30-40%. At some places total substitution of coal has been achieved. Many brick kilns in district Bijnore, Saharanpur, Rampur, Nainital, Vijaywada and Vishakhapatnam, etc., are using rice husk along with firewood to substitute 100 % coal.

Building Materials from Mining Wastes/Coal Ash: In continu-

ation of work reported earlier on flyash sand lime brick plant at Durgapur by Damodar Valley Corporation (DVC), Calcutta, the erection and commissioning of the plant has been completed. The initial trials for producing bricks with complete production line have also been conducted successfully. Investigations on the reduction of cost of flyash sand lime bricks by reducing the autoclaving conditions were carried out with more samples of flyash from different sources. Full size bricks were made at a moulding pressure 240 kg/cm² with and without using admixtures and steam cured at normal pressure. The results obtained indicate that by the addition of admixtures, the strength of the brick increases to the required values conforming to IS:12894-1990.

Local Sands for Ferrocement:

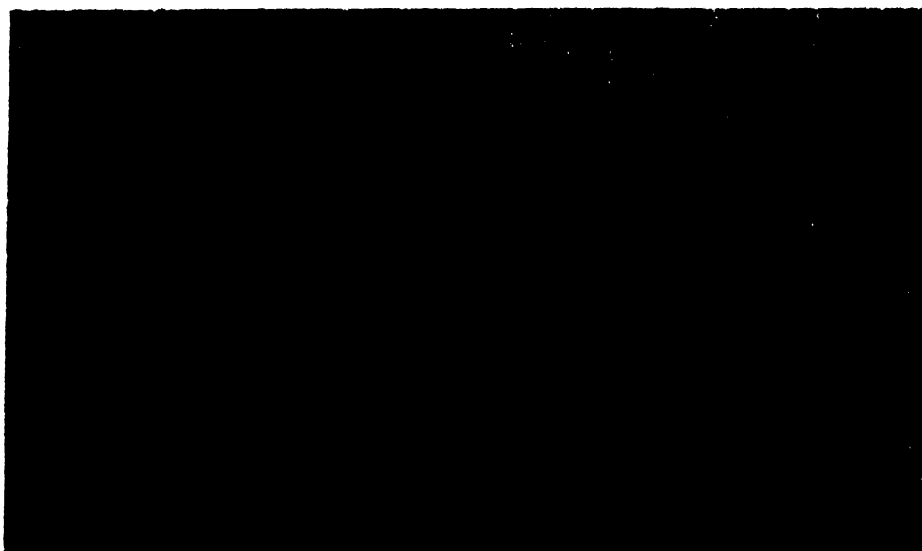
A number of locally available sands with varying fineness modulus were studied in superplasticized mortars. It was concluded on the basis of results obtained on water requirement, compressive strength, shrinkage, etc., that local sands can give appreciable properties comparable to costly graded sands for ferrocement works in the presence of superplasticizer.

Termite Control Measures in Buildings: Keeping in view the fact that Government of India has phased out the existing highly toxic chlorinated hydrocarbons, a systematic study to evaluate other eco-friendly pesticides was undertaken. Collaboration was undertaken with RRL-Jorhat to evaluate the chemical developed at RRL which controls termites in buildings and also acts as a preservative for cellulose building materials. The study carried out in last one year showed that the chemical is effective.

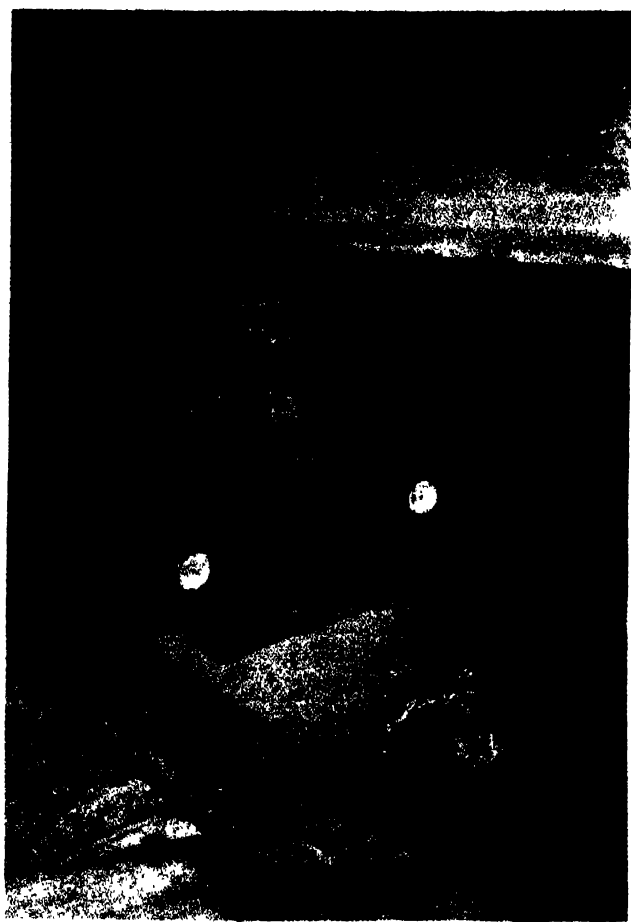
Pollution Control System for Lime Kiln :

The upgraded pollution control system for lime kiln evolved by the institute has been installed and commissioned on a kiln capacity 10 TPD at M/s Naroha Minerals Pvt. Ltd, Paonta Sahib (H.P.). The system is working satisfactorily without any adverse effect on the functioning and operation of the lime kiln. A patent on a scrubber which can be incorporated in a device useful for pollution control has been filed.

National Emission Standard for Brick Kilns : Studies were carried out on stack emissions (SPM, hydrocarbons and acidic gases),



Surface texture of the developed board



Load test on pile in progress

fugitive dust emissions, solid waste generation and noise pollution vis-a-vis raw materials, quality of fuel used and operating practices in different types of kilns in four zones of the country. In addition, impact of stack emission on ground level concentration was studied by dispersion modelling, and appropriate stack heights were calculated for different capacities of kilns. Based on these studies in different types of brick kilns in different zones of country, National Emission Standards has developed kilns of different capacity for dust and hydrocarbon emissions.

Coir-CNSL Board : The product is a composite material and can be used in place of wood effectively. It contains coir fibre and natural resin as the major con-

stituents. Both the constituents are agro-based and renewable. The current availability of coir fibre in India is about 1.65 lakh tonnes per year while the availability of CNSL is approximately 1.5 lakh tonnes per year. The process developed is at laboratory scale and scaling up of the same is needed for its commercialization.

Rigid PVC Foam Sheets : PVC foam boards/sheets have recently been introduced in the world market on a large scale. No indigenous technology is available for the manufacture of this product in India. A few prototypes have been made and evaluated. The work is in progress for technology scale-up and commercialization.

Computer Software Development : A computer software is under development which will help in selecting the right type of material for making door shutters for specific applications using alternative materials to wood. Extensive data have been fed in this menu driven package. Besides, it will also provide the following information: (1) Available alternative materials for different applications in buildings; (2) Properties of individual wood substitute material; (3) Details and addresses of various wood substitute manufacturers with retrieval facility; (4) Various tests and IS/BS/ ASTM Standards for performance evaluation of door shutters; and (5) Selection of wood

substitute materials for specific door shutter simply by replying set questions on the monitor.

Architecture & Physical Planning

EWS and LIG Housing: A design concept has been developed at the institute with a view to making built-up space more functional, efficient and to save on floor area. In the concept, a single larger space, convertible into two spaces, is provided for day and night time activities through integration of multiple-use furniture units. The space utilization for an average family of five persons is increased and all activities can be performed indoors and the side can be converted into multi-use table. After bolting the cup-board shutter, it can be rotated, along horizontal axis to convert the same into make shift bed at night. Number of dwelling designs, based on the concept, space norms and integrating space savers, have been worked out.

Computer-aided Architectural design: The institute has taken up an ambitious programme to develop "Expert System Software" in the field of housing and planning. It is an attempt to assist the architects, planners and other interested in the process of design and evaluation of housing programmes. The expert knowledge and results of the research studies in housing and planning will be made available to the users through this Expert System Software.

Educational Buildings for Rural Areas: More than 200 Navodaya Vidyalaya Complexes were completed in different parts of the country based on different designs, specifications and construction technologies recommended by the institute. At another 120 sites, the progress of construction is at various stages. The feedback on design

and construction of Navodaya Vidyalaya Complexes has been collected from different sites in different districts of the country. Based on the feedback received from sites, including the performance of the buildings already constructed, the limitations of availability of building materials, etc., a number of modifications were made in the existing designs.

Three Storey Building Design for Hilly Sites: A Navodaya Vidyalaya Complex normally spreads over 8-10 hectares, but on most of the hilly sites land area in the range of 6-8 hectares only is available. These sites generally have steep slopes with plantation and other site features. The land area available for planning buildings is therefore limited. Keeping in view the limitations of the hilly sites three storey designs were developed for school building, dormitory and staff residences.

Earthquake Resistant Buildings: Prior to 30 September 1993, when an earthquake of intensity 6.4 on the Richter scale hit parts of Maharashtra and Karnataka, most of the affected area was falling under seismic zone I as per the relevant Indian Standard. No structural provisions had been made in the design of buildings in this area to withstand earthquake forces. Hence Jawahar Navodaya Vidyalaya buildings constructed in Districts Latur and Osmanabad had developed a number of minor cracks in walls and in a few of the beams. These buildings were inspected soon after the earthquake and repair and strengthening measures were suggested. For new constructions to be done in the affected area, earthquake resistant measures were incorporated in the designs and drawings.

Building Processes, Plant & Productivity

Economical Construction Techniques for Floors/Roofs: An in-situ R.C. flooring/roofing scheme was planned with light weight cellular concrete filler blocks developed from flyash, quick lime, cement and a foaming agent. Advantages of use of cellular concrete filler blocks are its low thermal conductivity, good fire resistance, light weight, low cost and utilization of an industrial waste, i.e., flyash. Different mix proportions for the non-autoclaved cellular concrete blocks were tried and an optimal mix was selected considering both its compressive strength and density. To check the feasibility of constructing the R.C. filler slab and the performance of non-autoclaved cellular concrete blocks as a filler in the slab, an experimental slab was constructed. It is planned to construct a few more slabs and subject them to load tests to check the structural performance of the new flooring/roofing scheme. The scheme is expected to result in considerable saving in cement, steel and cost of construction, compared to conventional in situ R.C. slab.

Maintenance Management of Residential Buildings: Adequate maintenance at the appropriate time and cost is necessary to ensure that the buildings continue to provide required level of service and facility. For this, the organizational approach, systematic planning, scheduling for maintenance and development of cost information can help the management do better within the available means. In this context, the project on maintenance management was undertaken at the institute to study the structure of maintenance expenditure of residential buildings and to see the effect of time on buildings and of the nature of occupancy on maintenance cost

and frequency of occurrence of various types of maintenance problems.

Structural Engineering

Design and Draughting of Reinforced Concrete Members: The following software packages have been developed.

Beam: Package for design of continuous RCC beams (rectangular, L, T sections) as per IS: 456 - 1978 and draughting of the reinforcement drawings for the same have been developed. The software is interactive in nature. All the input parameters such as number of beams to be designed, number of spans, external forces (bending moment, torsion and shear force) at each node, materials, properties, width of section, diameter of reinforcement, etc., are fed in an interactive mode. If required, the diameter of the reinforcing bars can be revised during the design stage. The draughting part of the package is capable to draw the longitudinal and cross sections of the simply supported and continuous beams showing positive and negative reinforcement and spacing of stirrups in the given scale on AO to A4 size paper.

Column: Package for design of axial compression and uniaxial bending of short rectangular columns as per IS: 456 - 1978 and draughting of the reinforcement drawings for the same have been developed. All the input parameters are fed in an interactive mode. The draughting part of the package is capable to draw the longitudinal and cross-sections of the columns on AO to A4 size paper. Depending upon the size of the paper specified, the program will calculate the scale required for all the problems to be drawn in a single sheet. If required, the user can specify his own scale.

Geotechnical Engineering

Building Foundation in Expansive Soils: The expansive soils are problematic for the buildings laid on shallow foundations. These buildings have developed cracks of mixed nature (vertical, horizontal and diagonal). A field study was therefore pursued since September 1992 to monitor the performance of building foundations of three residential buildings and one electrical substation constructed in 1982-83 at KRIBHCO, Surat.

To adopt the under-reamed pile foundation prior to the construction of building, provision of apron was suggested for buildings yet to be constructed. To the post-constructed buildings the filling of cracks with a suitable ratio of mortar (sand, cement and lime) mix was suggested depending upon the width of cracks.

Pile Diagnostics and Analysis: The requisite data has been generated for precise interpretation of integrity test results as well as to quantify the variations in pile cross-section and defects. The analysis of integrity test signals (velocity reflectogram) offers both qualitative and quantitative information. The signal matching technique provides a reasonable quantitative estimate of defects/variations in cross section. A draft on *Guidelines for Non-destructive Integrity Testing* was prepared for BIS which is under wide circulation.

Interaction with Water and Underground Cavities: VHF electromagnetic waves occupy the frequency band (30-300MHz) in the electromagnetic spectrum. In the study, 100 MHz and 200 MHz frequencies were applied for moderate probing depth and vertical resolution to detect water-soil interface layers.

Surveys conducted with 200 MHz system also identified the underground mining channel beneath the foundation in a built-up residential area in South Delhi. Appropriate design of the survey procedure facilitated the delineation of the path of an abandoned mining channel. Subsequent remedial measures to grout the channel and foundation strengthening measures restored the residential complex.

Foundation Technologies for Waste Lands: Four innovative foundation technologies for deep layers of soft clay deposits in creek and waste lands have been introduced such as (i) Skirted granular piles, (ii) Self - setting soil slurry piles, (iii) Geofabric reinforced pad foundations and (iv) minigrouted piles. With a view to study the behaviour of new foundation technologies, a site was selected in Bombay having predominantly saturated clay deposits up to large depths. Based on the detailed sub-soil investigation and analysis of the data obtained both from field and laboratory and full scale field load test on prototype foundations at Dronagiri, Bombay, several conclusions were arrived at.

Fire Research

Estimation of Sprinkler Actuation Time: Theoretical models were formulated to simulate the complete heat and mass transfer process associated with a fire. Such models are naturally the heart of any systematic approach for safe designs. Mathematical computer models of varying levels of complexity have been developed to describe realistically the complex fire phenomena to provide confidence and to predict the consequences of a fire.

Predicting Disastrous Effects of Explosion: Mathematical models have been developed

for predicting minimum ignition temperature and minimum explosible concentration for inorganic dusts. These models can be used directly to examine the probability of explosion in a dust-air environment without any particular explosion tests and for preparation of graphs representing domain of flammability and thermal ignitability of dusts. Conceptual models have been formulated to predict rate of pressure rise and maximum explosion pressure of inorganic dusts.

Efficiency of Buildings

Wind Pressure on Low-Rise Buildings: Investigations on the effect of neighbouring buildings on wind pressure distribution on low rise buildings were carried out on models in an open - circuit - sucking type boundary layer wind tunnel. Wind pressures on models of buildings were measured with the help of a system consisting of a scanning valve, a digital micromanometer, a personal computer and its peripherals. The on line data acquisition, processing, display and storage are performed by a software specifically developed for this purpose. The studies covered the common types of layout comprising linear row of buildings, parallel rows of buildings, staggered blocks, segregated aligned blocks and chequered array of blocks.

Energy Consumption Index for Buildings: The Energy scenario of India shows that the consumption of energy in household sector has increased from 8.4 % in 1972-73 to 12.40 % in 1993-94 of the net available energy. Similarly in office sector the increase is from 10.2 % in 1972-73 to 14.6 % in 1993-94. To study various aspects of energy consumption and to evolve consumption indices in different climates of the country, an R & D programme under the spon-

sorship of the Building Materials and Technology Promotion Council, Ministry of Urban Development, New Delhi, was undertaken.

Expert System on Environmental Efficiency of Buildings: A database on climates of the country along with thermophysical properties of the materials, heat transfer coefficients governing different situations, thermal characteristics of single and multislabs components, incident properties with respect to heat and light of opaque and transparent materials, etc., was created.

Sun Tracker Device: A sun tracking system has been designed for measurement of solar beam illuminance as part of the International Daylight Measurement Programme (IDMP). Along with the sun tracker for direct beam illuminance, the IDMP measurements at Roorkee include global and diffuse horizontal illuminance and irradiance, zenith luminance, vertical illuminance and irradiance in the East, West, North, South directions, sunshine duration, spectral energy distribution, sky luminance distribution and atmospheric turbidity.

Rural Buildings

Unreinforced Pyramidal Roof: The analysis and design of unreinforced pyramidal roof is not possible by available classical methods. Therefore the structural analysis was done by 3-Dimensional Finite Element method on ANSYS Computer work station. It was found that stresses get sharply reduced upto 15° slope and after that the reduction in stresses is not very significant while the surface area of the pyramidal roof increases substantially. Therefore keeping in view the overall cost and reduction in stresses, it is proposed that the slope of the roof may be kept 15° to 20° according to the

local preferences and other conditions.

Houses for Disaster Prone Areas: Although circular plan with conical roof is the most suitable form of houses in cyclone affected areas as it will face minimum thrust, uplift and torsion but there are limitations in usable spaces, furniture layout and functional performance of various activities within such houses. The cost and time utilized in the construction are other important factors. Considering different activities performed in the house and based on anthropometric studies, square shape house plans for one room, two rooms and three rooms have been developed. □

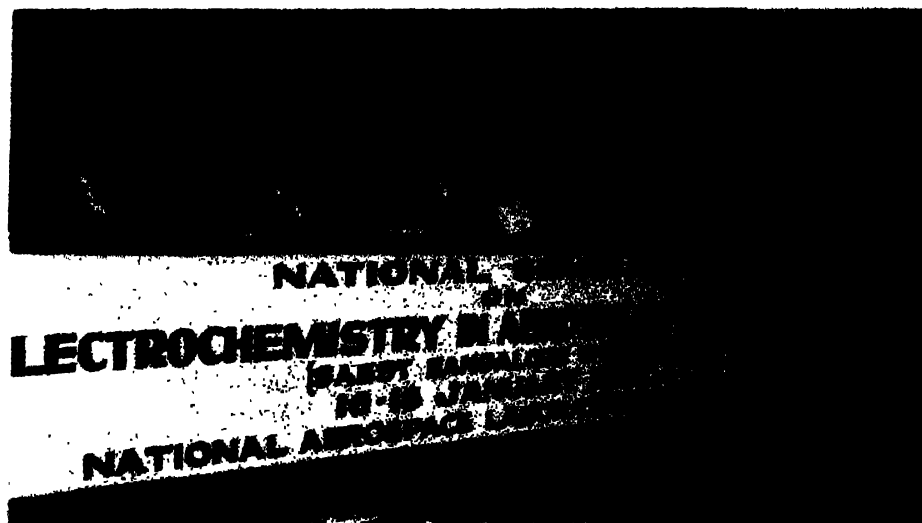
Seminar

Electrochemistry in Aerospace Technology

A National seminar on 'Electrochemistry in Aerospace Technology' was organized by the Bangalore Chapter of SAEST at National Aerospace Laboratories on 16 January 1995. There was a most remarkable address by Prof. U.R. Rao on a large number of is-

sues but essentially on energy-related problems in space. There was another thoughtful address by Prof. R. Narasimha in which he explained how a rupee invested in electrochemistry in India has the potential to multiply by a factor of 30— whereas NASA acknowledges that its best products have achieved scale-ups by factors of about 12-15! There was a passionate appeal by Prof K.I. Vasu to embrace the Swadeshi spirit in Indian science and technology.

The function opened with a welcome speech by NAL Acting Director Dr B. R. Somashekar. Dr Somashekar expressed his satisfaction that NAL had been chosen as the seminar venue and went on to briefly describe NAL's many successes in the area. Prof Vasu, the former CECRI Director, then briefly introduced the programme and said that Bangalore is the heart, brain and nerve centre of aerospace technology in India and so was the obvious choice of the venue. Apart from his plea to be self-reliant, Prof Vasu also called for a greater role for universities in Indian S & T. "Otherwise, how are we going to mould the future generation?" asked he.



National Seminar on "Electrochemistry in Aerospace Technology" in progress

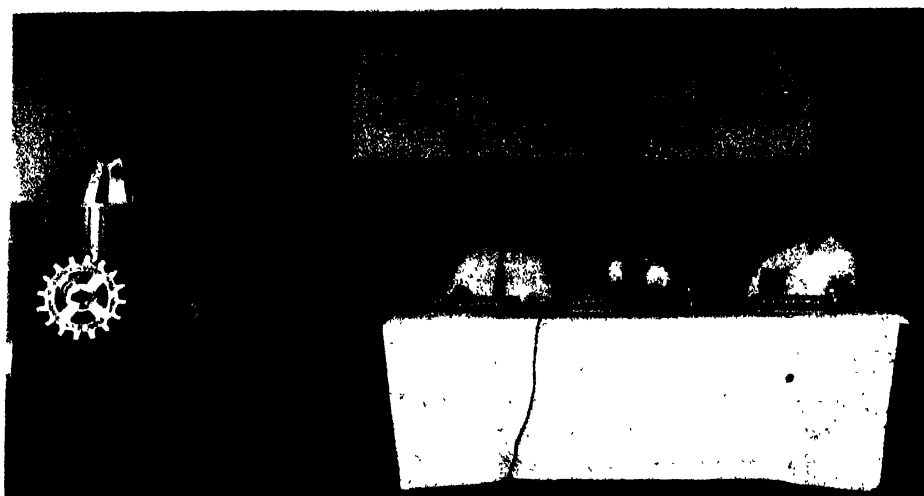
The principal speaker of the day was Prof U.R.Rao. "We have the capability in India and I am confident that we will eventually use our own cryogenic technology. Indeed, India's degree of self-reliance in space is already the envy of many", he said. Prof. Rao then went on to recall the instance when Dr Valluri and NAL rose to the occasion to deliver the dynamic balancing knowhow to ISRO. But the best moments in Prof Rao's address came when he talked of energy applications in space; he discussed questions related to solar eclipses; he explained how every additional kilogramme of payload costs US \$ 30,000; how 50 % of all space failures are due to power system; how managing problems of vibration, acoustics, radiation and thermal activity is an art; and how a satellite which loses its lock can fail to 'find the earth'. Prof Rao went on to ask whether satellites 20 years hence would get bigger or smaller and talked of the promise of fuel cells and finally wondered how we are going to tackle the problem of pollution in space.

Prof. R. Narasimha applauded the effort of Indian electrochemists. "In electrochemist we have a source of unrecognised wealth, and the real problem for R & D managers is to exploit this wealth", he added. The function, attended by Dr S.R.Val-luri, Dr C.G. Krishnadas Nair and Dr S.R. Rajagopalan, among others, ended with brief remarks by Dr G.V. Subba Rao, Director, CECRI, and a vote of thanks by Dr Indira Rajagopal. □

National Science Day Celebrations

CFRI

ON 28 February, 1995, the newly constructed CIBORIUM was the venue for the celebration of National Science Day to com-



Dr. B. Roychowdhury speaking on 'Science for Health'. On the dais are Samir Sen and Dr. Kotur S. Narasimhan of CFRI, Dhanbad

memorate the Nobel Prize winning discovery of C.V. Raman. Dr. Kotur S. Narasimhan, Director, Central Fuel Research Institute, Dhanbad, who presided over the function, welcomed everybody and stressed upon the importance of the day in the history of modern India. Prof. Bhaskar Roychowdhury, ex-Vice Chancellor, Calcutta University, was the Chief Guest who gave a scholarly discourse on 'Science for Health'. He discussed health care through the ages from the time when man attributed diseases to supernatural causes to the present when science and technology has contributed considerably to medicine and surgery. He also pointed out the correlation between civilization and medicine. He claimed that the ancient civilizations of India and Egypt had the most scientific system of medicine.

Prof. Roychowdhury described medicine as a 'wholesome' system, whose progress depended on developments in botany, zoology, and metallurgy particularly Al-chemistry. He pointed out that Ayurveda is today catching on all over the world. Stating that the modern medical facilities are like nuclear energy, he cautioned for utmost care in their judicious, ethical and need based use. The prohibitive

cost of sophisticated medical treatment however makes it accessible only to 12 per cent of our population. Proper planning of health care and mass education are therefore required, particularly in checking diseases like child diarrhoea, polio and measles which are still rampant in the developing countries. In the last Prof. Roychowdhury urged people to cultivate scientific temper - the purpose with which the National Science Day is celebrated. Shri Samir Sen, Head, Technical Information, proposed a vote of thanks. □

NIO

THE National Science Day was celebrated in the National Institute of Oceanography, Goa, on 28 February, 1995 to commemorate the discovery of "Raman Effect" by the great scientist C.V. Raman. The institute was kept open for the general public. Essay competitions on "Science for Health" and debates on different scientific topics were held.

A function was organized in the evening to celebrate the day. Padma Shri and Arjuna Awardee Shri Gulshan Rai, Deputy Collector of Customs, Panjim, was the Chief Guest. A video cassette on



Gulshan Rai giving away the prizes. Seated to his left is Dr E. Desa, Director, NIO, Goa

Shri Gulshan Rai's peril-filled voyage around the world on board 31-32 feet sailing yacht was shown. Cash prizes and certificates were given away to the best three essayists and debators at the hands of the Chief Guest.

In his welcome address Dr. Ehrlich Desa, Director, NIO, un-

derlined the purpose of such celebration and of holding various competitions. He said that we owe a lot to the society and we have therefore the responsibility for its upliftment and betterment. This day should certainly infuse the qualities of discoverers such as C.V. Raman, he added. □

RRL-Jorhat

REGIONAL Research Laboratory, Jorhat, celebrated the National Science Day with a well charted out programme on 28 February 1995 amidst solemnity and grandeur. On this occasion the laboratory was open to students and teachers of schools and colleges as well as the public. More than 3,000 people visited RRL on that day and went round the various departments of the laboratory to see the various research activities in progress. The RRL scientists were also available to explain their researches and experiments. A competition on giving extempore speeches on a scientific topic was also held among the children of the local educational institutes. □

CRRI

CRRRI, New Delhi, celebrated the National Science Day on 28 February 1995 to commemorate the great discovery 'Raman Effect' made by Nobel Laureate C.V. Raman in 1928. Prof. Jagdish



National Science Day celebrations in progress at RRL-Jorhat



Prof. Jagdish Mukhi, the Finance Minister of Delhi Government, giving the inaugural address on the occasion of National Science Day celebrated at CRRI, New Delhi. Sitting on the dias (from left) are Prof. D.V. Singh, Director, CRRI, and Shri B.L. Parasher, Scientist, CRRI

Mukhi, Hon'ble Finance and Planning Minister, Government of Delhi, was the Chief Guest who gave a talk on 'Pollution, particularly generated by road transport, control and strategy'. In his talk, Prof. Mukhi drew attention of scientists to the growing menace of pollution emanating from the ever increasing traffic on roads. Prof. Mukhi stated that Delhi is the most polluted city in India and a number of steps are being planned by the Delhi Government to control air and water pollution. He expressed the need for effective planning for de-congestion and traffic regulation in metropolitan cities. He specifically mentioned the need for using catalytic convertors and lead-free petrol. Earlier, Prof. D.V. Singh, Director, CRRI, gave a brief account of the events leading to the discovery of fluorescence of pure liquids which are strongly polarized and which later became known as 'Raman Effect'. He pointed out that since Raman no scientific discovery has been made on the Indian soil to bring a Nobel Prize to India. He said that this is the very reason that we should re-

member Raman and what he did in and for science and derive inspiration from him to excel in scientific pursuits. Prof. Singh formally introduced the Chief Guest. The function was concluded with a vote of thanks by Shri B.L. Parasher, Head, Information Liaison and Training of the institute.

Earlier, during the day, an Open House on 'Marketing of CRRI Knowhow in Service Sector' was arranged, which was presided over by Prof. D.V. Singh. In introductory remarks, Prof. Singh mentioned the need of private sector participation in highway sector, growing user interests, identification of marketable technologies and services which are presently under various stages of development for their commercialisation. Dr H.R. Bhojwani, Head, Technology Utilisation Division, CSIR, gave a talk on 'Marketing, perception & overview'. Dr. Bhojwani described the emerging profile of the market driven economy and the constraints of the shrinking non-plan budget. He suggested that need-based research should be done to

fulfil the needs of the industry and appropriate training programmes should be organized to develop the marketing skills of scientists. Shri M.V.B. Rao, Head, Bridges Division and Chairman Marketing Group, CRRI, presented the details of services and knowhow developed at CRRI for exploitation by the market. A number of suggestions were given by scientists who participated in the Open House to enhance the marketability of CRRI knowhow and service. In a way, it was a unique exercise to acquaint scientists with the marketing of CRRI's knowhow. □

Technology Transfer Agreements signed by RRL-Bhopal

THE Regional Research Laboratory (RRL)-Bhopal, signed an agreement with M/s Perwall Wallace Ltd, Bhopal, on 7 February 1995 for transferring the technology for FRP gear cases of traction motors of 2600 hp locomotives. Field trials of gear cases undergoing on the Mugalsarai Section of South Central Railway have indicated that there is nothing adverse in the operation since June 1994. RRL-Bhopal also transferred a knowhow on low voltage capacitor electrolyte to M/s Eleaps Ltd, Mandeep.

During the processing of Zinc ash for the production of Zinc, Manganese oxide (MnO) is used as a reductant. RRL-Bhopal has developed a knowhow for the production of MnO from pyrrrolusite for M/s Bharat Zinc Ltd. An agreement was signed on 24th March 1995 for a collaborative project for the development of pilot level process. □

Foreign Visits

Polish Scientists visit CFRI

UNDER the Programme of Scientific Cooperation between CSIR and Polish Academy of Sciences, Dr Piotr Dyla and Dr Krzysztof Stanczyk visited the Central Fuel Research Institute (CFRI), Dhanbad, and its sub-station units during 14-18 February 1995. The Polish scientists exchanged views with CFRI scientists on coal hydrogenation, catalysis and other related activities of the institute. They were primarily interested in the study on elimination of sulphur from coal in pyrolysis and hydro-pyrolysis, which is the on-going project headed by Dr S.K. Shrivastava. They discussed the project with Dr Shrivastava and were delighted with its progress at CFRI and expressed their keen interest for mutual exchange and cooperation in this connection. They also showed interest in coal characterization and resource quality assessment studies. They also visited CFRI unit at Ranchi. □

Japanese Companies seek CSIR Technologies

SEVERAL major industrial concerns of Japan showed keen interest in the CSIR technologies displayed at the International Technological Exposition 'Techno Messe Kansai'. Held in Osaka during 28 February - 2 March 1995, it was an exclusive fair which provided entrepreneurs an opportunity to decide on the transfer of technologies. A large number of countries from all over the world participated in this exposition.

The CSIR institutes which displayed their technologies at the exposition include Central Salt & Marine Chemicals Research Institute, Indian Institute of Petroleum, National Chemical Laboratory, Indian Institute of Chemical Technology, Central Glass & Ceramic Research Institute, Centre for Cellular & Molecular Biology, National Environmental Engineering Research Institute and Central Leather Research Institute.

The multinational giants from Japan, M/s Matsushita Electric Industrials Co. Ltd (trade name *National Panasonic*), showed interest in 'Zeolite powder'- detergent grade developed by CSMCRI. M/s Technica Co. Ltd and M/s Proceed Co. showed interest in the 'Low air pressure automizing film burner' developed by IIP. Other parties who found this burner useful are M/s NETI, Budapest, and M/s J. Tech Inc., Tokyo. Another important entrepreneur of Japan, M/s Toyo Kasei Kogyo, expressed interest in 'Sodium azide' technology developed by IICT. The other technologies which evoked interest among the entrepreneurs are related to vitamin B6, food products, butendiol and microbial disulphurization of fossil fuel. In addition, several scientists and planners not only from Japan but from various European countries as well visited the CSIR display. □



Polish scientists visiting an exhibition on the R&D efforts of CFRI, Dhanbad

Honours & Awards

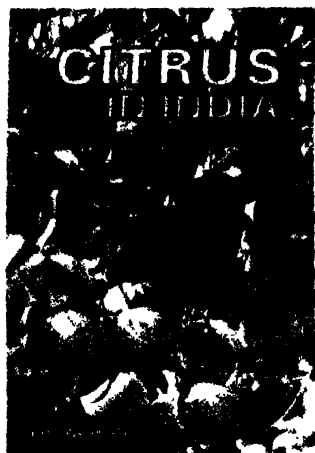
V.T. Rajagopalan

SMT V. Thamizharasi Rajagopalan's Ph.D. thesis on 'Post Harvest Handling and Storage of Onion (*Allium cepa* L.)' has been awarded the ICAR Jawaharlal Nehru Award for being the best thesis in agriculture or allied sciences for the year 1992 at a function held at Mavlankar Hall on 11 March 1995. She was awarded Rs 10,000 and a citation. She worked as a Research

New Publications

Citrus in India

CEREALS and vegetables apart, fruits have a significant role to play in human nutrition. India produces a large variety of fruits. Citrus fruits are next only to mango and banana produced in large quantities. They



are rich source of vitamins and minerals.

Citrus in India is a profusely illustrated book. It is written in

an easy-to-understand style and gives information on various citrus fruits, their history, different varieties, breeding, cultivation and utilization. Special emphasis is given to a variety of industrial products and their processing.

Author: Dr N.R. Mankad, pp. 144, Price Rs 200.

Tea in India

Tea, coffee and cocoa are the three important non-alcoholic beverages from nature's rich storehouse of plant resources. Of the three, tea is the oldest known and the most popular beverage.

Tea in India is a profusely illustrated book. Written in an easy-to-understand style, it gives an overview of the tea trade especially the role of Indian tea industry in the world tea market. The book also focusses on the history, characteristics of the plant, genetic improvement of the bush, cultivation, different types of tea and their manufacture, therapeutic properties, and nutritive value of the beverage.

The above books are first and second in number in the series of *Encyclopaedia of Natural Wealth of India* brought out by the Publications & Information Directorate.



Author: Dr Bala Subramanian, pp 126, Price Rs 200.

Orders for these publications should be accompanied by Money order/I.P.O./Demand draft/Cheques, made payable to 'Publications & Information Directorate, New Delhi', and sent to: The Sales & Distribution Officer, PID, Dr K.S. Krishnan Marg, New Delhi 110012. □

Fellow under the guidance of Dr P. Narasimham, Scientist, Post Harvest Technology Laboratory of the Department of Fruit & Vegetable Technology of the Central Food and Technological Research Institute (CFTRI), Mysore, and was awarded Ph.D. by the University of Mysore in 1991.

The significant R & D achievement of Smt Thamizharasi's work is the development of a comprehensive handling and storage technology for five month storage of onions at ambient temperature and relative humidity (20-35°C, RH 50-90

%) with a total loss of 20 % as against 45 % loss in the conventional method of ambient storage. Basic studies included (a) the water vapour loss from onion bulb (b) the mode of *Aspergillus niger* infection and its control by heat and/or sulphur dioxide treatment (c) the sprouting behaviour of onion bulbs at different temperatures and relative humidities (d) varietal variations in the storage behaviour of 12 commercial cultivars (e) designing and testing of a prototype storage structure (capacity 300 kg) along with the design for a 20 tonne field level storage structure.

The study was also conducted on the problems faced during onion storage. It gives a comprehensive approach to extend the ambient storage life of onions, with least storage loss due to loss in weight and microbial spoilage, thereby curtailing spoilage to around 20 % as against conventional loss of around 45 %.

Navin Chand

DR Navin Chand, Scientist, Regional Research Laboratory-Bhopal, has been elected as a Fellow of the Institute of Materials, London, U.K. □

Printed and Published by Dr G.P. Phondke, Director, Publications & Information Directorate (PID), Dr K.S. Krishnan Marg, New Delhi - 110 012
Printed at PID Printing Unit

Editors : Dr B.C. Kashyap, Dilip M. Salvi and Madhu Sahni

Production : Kamal Khosla

Annual Subscription : Rs. 60
Single Copy : Rs. 3.00

Phone: 5786301

Gram: PUBLIFORM

Telex: 031-77271

E-mail: pid@simnet.ernet.in.

Fax: 5787062

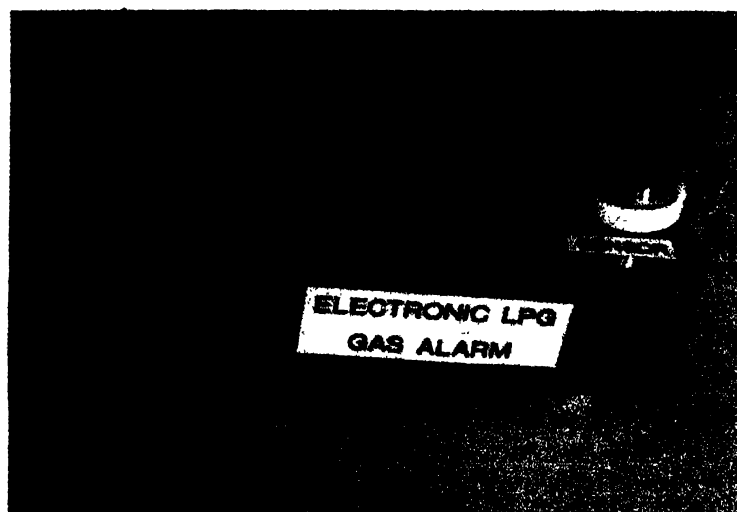
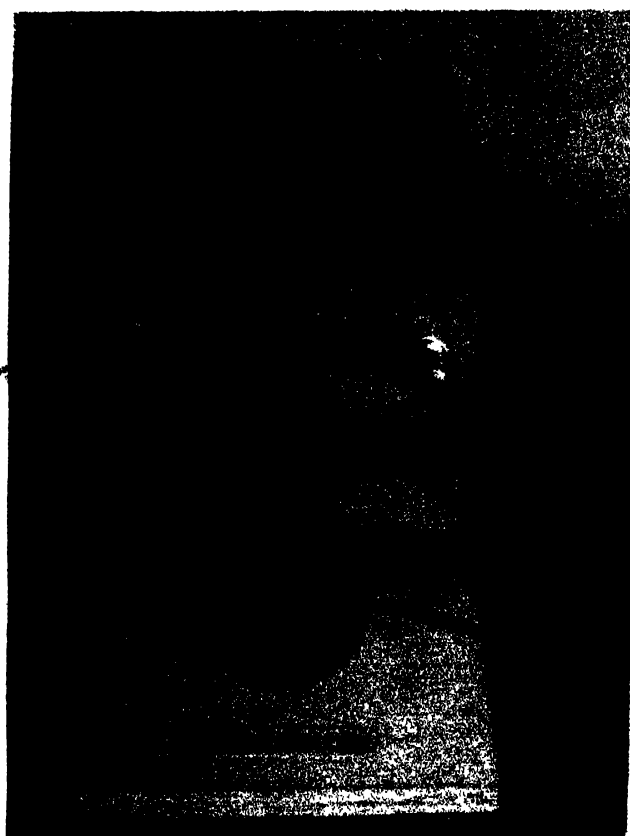
RN 4512/57

CSIR

NEWS



VOL 45 NO 10 30 MAY 1995



Moisture meter and Electronic LPG gas alarm unit developed at the Central Glass & Ceramic Research Institute, Calcutta.

IN THIS ISSUE

Moisture Meter for Industry 146
Electronic Gas Alarm Unit 146
Hydrothermal Vents Discovered 147

Indian National Scientific
Documentation Centre,
New Delhi
S&T Activities: 1993-94 149

Workshop on Aromatic and
Medicinal Plants 153
Workshop on Termite Control 156

R & D Flashes

Moisture Meter for Industry

MOISTURE not only constitutes an important part of the environment but also plays a significant role in material preparation, fabrication and storage. A knowledge of moisture content is of particular interest in ceramic processing, cement industry, food processing, plywood processing and electronics industry.

The Central Glass & Ceramic Research Institute, Calcutta, has designed and developed a portable moisture meter for quick and accurate measurement of moisture content in almost any powdered material. The instrument can also be used for measuring the surface moisture of wood, cement, concrete, etc., and of large components like unfired porcelain and other ceramic bodies.

The instrument is small, lightweight, can be operated on mains or battery and gives digital read-out. It is particularly designed for

measuring moisture content of porous solids of powdered materials. The measuring range is 0.1% to 6% within an accuracy of $\pm 10\%$ and display resolution of 0.1%.

The sensor of the meter is a LCR tank circuit. The Q of the circuit changes with the change in impedance of the material. Again, impedance varies with the moisture present in the material. Hence Q is controlled by the variation of water present in the material. The change in Q , calibrated in millivolts, is the direct indicator of percentage of water present in the material. □

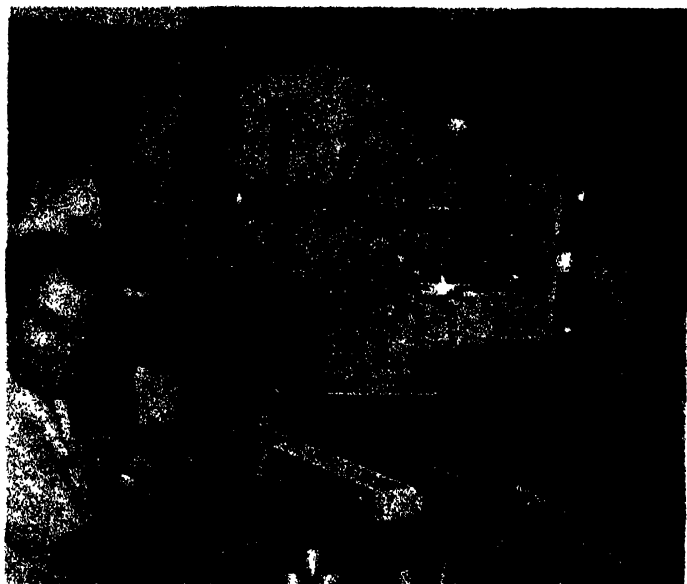
Electronic Gas Alarm Unit

A prototype electronic LPG (cooking gas) alarm has been developed as a home as well as industrial safety device by the Electroceramics Group of the Central Glass & Ceramic Research Institute, Calcutta. The LPG sensor element is a zinc oxide thin film (3-5 micron thick) deposited on an alumina tube and sensitised with palladium. The film is maintained

at an operating temperature of 100-150°C by a 2-3 W heater coil placed inside the tube. The sensor element is placed inside metallic housing having a wire mesh at the top through which LPG gas can come in contact with the sensor. When LPG leaks in the environment around the sensor, a sharp fall in the sensor resistance occurs which sets off a flashing red light and a warning buzzer. □

Digital Mapping System

WILD B-8 is a conventional analogue stereo photogrammetric instrument which uses stereo pair of overlapping aerial photographs to generate three dimensional coordinates from opto-mechanically created stereo model of the terrain. Modern analytic instruments provide excellent features for capturing maps digitally by combining computer technology with photogrammetric instruments. But these instruments are expensive; the existing first generation instruments cannot be completely replaced with this new technology.



DIGIMAP system installation at Bhubaneswar (left) and Data acquisition system at Gulmar Tea Estate (right)

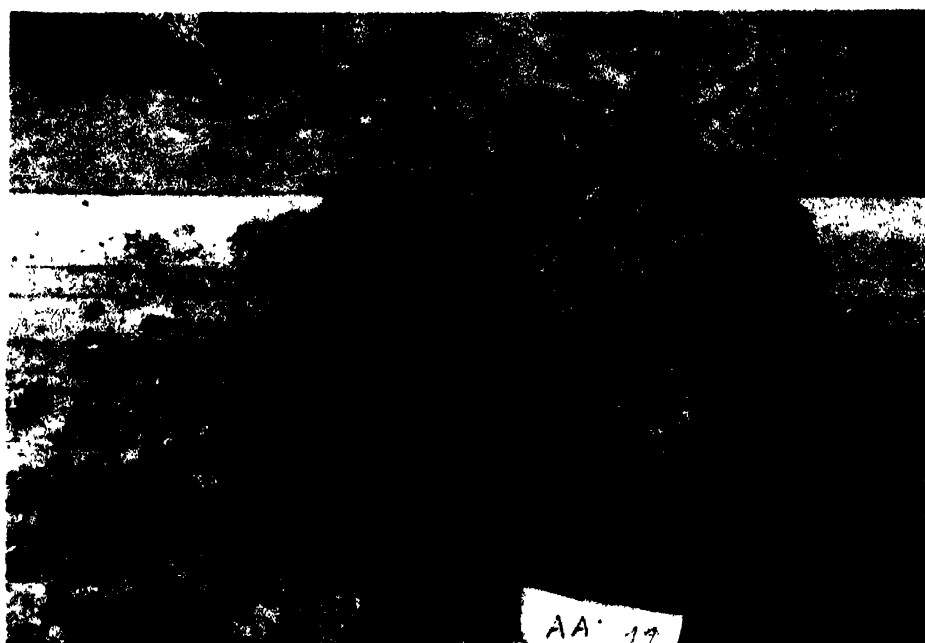
Digital Mapping System (DIGIMAP) developed by the Central Electronics Engineering Research Institute, Pilani, converts the widely used WILD B8-S photogrammetric instrument into a digital workstation. The old system can be upgraded within 24 h and used for capturing maps in digital format with 100% compatibility to Intergraph Interactive Graphics Design System (IGDS) file structures. Six DIGIMAP systems have been installed in the Survey of India. □

Computerized Coordinate Recording System

PC-EK-22 is a Computerized Coordinate Recording System developed by the Central Electronics Engineering Research Institute, Pilani, for creating land records. Its knowhow has been released to R&D Directorate, Survey of India, Hyderabad. Six systems have been delivered to the Survey of India which are being used for the Angul-NALCO project for creating land records. □

Data Acquisition System for Tea Processing

WITHERING process in the tea industry can be visualised as a two phase operation, viz., (i) chemical wither, where the number of bio-chemical reactions set in ultimately decide the quality of tea; and (ii) physical wither, which decides the surface characteristics of tea leaves. A collaborative R&D project was taken up by the Central Electronics Engineering Research Institute, Pilani, with the Tea Research Association, for development of appropriate automation system for the withering process.



A chunk of volcanic rock with hydrothermal vents collected by NIO scientists from the Andaman Sea

A Data Acquisition System for acquiring withering trough parameters such as leaf temperature, ambient and conditioned air temperatures, dry and wet bulb temperatures, resistivity and dielectric behaviour of leaves, fan direction, speed and air velocity to the trough has been commissioned at Mohurgaong and Gulmar Tea Estate, Siliguri, West Bengal, for field trials.

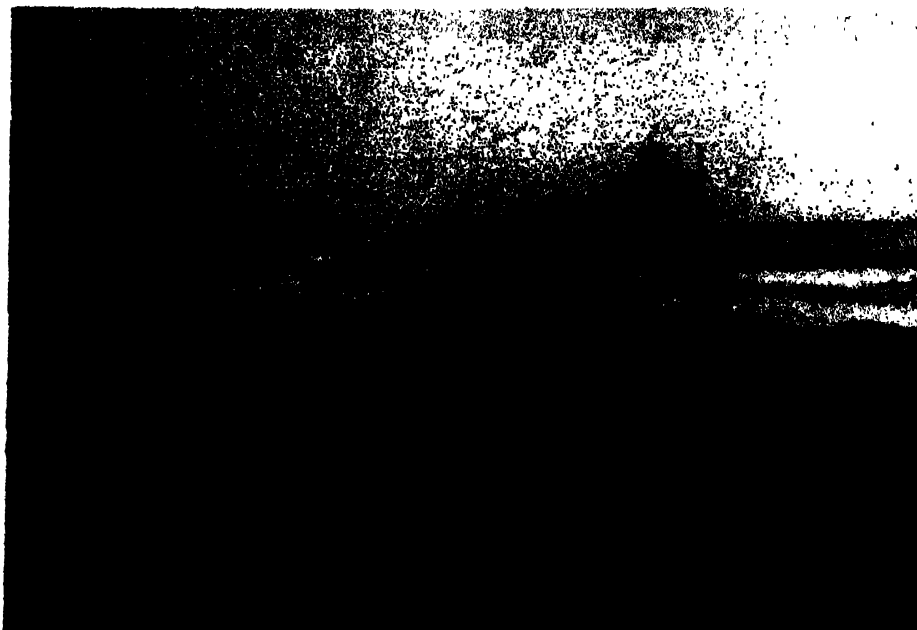
The above mentioned parameters were correlated with biochemical parameters such as caffeine content, water soluble substance, total oxidisable matter, etc, and were also compared with taster's evaluation marks for optimising withering time to achieve consistency in the quality of withered leaf. □

Hydrothermal Vents Discovered

THE scientists of National Institute of Oceanography, Goa, have discovered hydrothermal vents in the Andaman Sea within the Exclusive Economic Zone

(EEZ) of India. A team of scientists led by Dr Ch. M. Rao from the Geological Oceanography Division of the institute participated in a cruise from 19 March to 13 April 1995, onboard the chartered vessel *A.A. Sidorenko* to carry out geological and geophysical studies in the Andaman Sea. These studies have provided a strong evidence for the formation of hydrothermal minerals in the region. The samples collected by the team include hydrothermal vents and rocks containing metal sulphide particles and clustered metallic spheres. Vents are openings through which hydrothermal solutions with temperature upto 300°C are ejected into the seawater. A large specimen collected containing vents weighs about 40 kg.

Hydrothermal mineral formation processes involve circulation of seawater through volcanic and plutonic rocks near spreading centres, dissolution of metals from the rocks and precipitation of these metals in the form of mineral deposits when the hot solutions come in contact with cold seawater. The



Spilled oil from the grounded *Sea Transporter*

mineral phases include sulphides containing major metals, such as copper, lead, zinc and noble metals, such as silver, gold and platinum.

Hydrothermal mineral deposits have been reported from several locations in the Pacific and Atlantic Oceans. This is the first time that a positive evidence has been obtained from the Andaman Sea. In the near future, the scientists plan to use advanced techniques such as underwater television and remotely operated vehicle observations as part of the detailed exploration in the area. □

Fly-ash Stowing Technology

THE Central Mining Research Institute (CMRI), Dhanbad, has developed a technology for dense fly-ash filling of underground mine cavities and has successfully proved its efficacy in an underground experiment recently.

The pilot field experiment was carried out at GDK-I mine of SCCL in Ramagundam area in Andhra

Pradesh as a joint venture of CMRI, Ramagundam Super Thermal Power Station of NTPC and Singareni Collieries Company Limited. The CMRI team was led by Dr D.N. Thakur, Head, Stowing Laboratory.

According to Prof. Bharat B. Dhar, Director, CMRI, this technology would not only help in solving the increasing problem of fly-ash disposal from coal-fired thermal power stations but also in conserving river sand. A huge amount of this important building material is hitherto used in stowing operations.

In India, there are 24 coal-fired thermal power stations of various sizes generating nearly 15 million tonnes of fly-ash per year. Gradual accumulation of fly-ash in the vicinity of these plants not only blocks large free surface area but also creates environmental problems.

According to Dr D.N. Thakur, the packing with fly-ash provides better resistance against roof convergence and surface subsidence with less pumping cost and

thereby increases safety. It also eliminates the risk of fire which is a dreaded phenomenon of the Indian coalfields. The firm foundation offered by the consolidated pack of fly-ash can also help in mechanical operation in upper sections of thick seams and thereby enhance production and productivity.

It is estimated that this system would help extraction of additional coal worth of Rs 2,000 million every year from the partly extracted and abandoned mines if implemented properly.

The underground mines in Jharia, North and South Karanpura, Wardha Valley, Talcher, Ramagundam and Kothagudam coal fields, which face acute shortage of river sand, can now therefore use fly-ash without any hesitation, as most of the coal-fired thermal power stations are situated at the doorsteps of these mines. □

Beach Ecology at Sinkerim

STUDIES conducted by scientists of the National Institute of Oceanography, Goa, on the impact of oil spillage caused by grounding of *Sea Transporter* at Sinkerim beach on 5 June 1994 indicate lower concentrations of chlorophyll 'a' and phytoplankton cells, in the region of maximum leakage, as compared to that noticed 5 km away near the Calangute beach.

About 2 km stretch of the beach was infested with oil film and tar balls. This had an adverse effect on the sediment dwelling microfauna showing decrease in population in comparison to baseline data. While oil film and tar balls were noticed at Calangute beach at a distance of 1.5 km

north, no adverse effect on intertidal fauna was observed. □

Marine Explorations at Dwarka and Poompuhar

OFFSHORE explorations conducted by scientists of the National Institute of Oceanography, Goa, at Bel Dwarka have revealed a protohistoric settlement about 300 m towards the sea. Airlifting in this area revealed the late Harappan pottery dateable to 1600-1500 B.C. A large quantity of ceramic wares collected from onshore and intertidal zone is dateable to the late Harappan and Early historical period (2nd century B.C. to 7th century A.D.). One of the potsherds is inscribed in the late Harappan script which is provisionally read as 'baga' meaning 'create'. The prominent shapes in the late Harappan pottery are convex sided bowls, jars and dishes. Offshore explorations at Dwarka have brought to light stone structures including bastions, walls and anchors.

In collaboration with the Department of Archaeology, Govern-

ment of Tamil Nadu, NIO conducted exploration of the intertidal zone to trace the structural remains of early historical period at Poompuhar, an early Chola port on Tamil Nadu coast. An important finding is a brick structure exposed in excavation during the lowest low tide. The dimension of the structure is 2 m x 45 cm, and five layers of the brick structure were visible in water. The terracotta ringwells in the intertidal zone at Vanagiri, which was a suburb of Poompuhar, were also exposed. The diameter of the ringwell is 1.5 m. The habitational site of ancient Poompuhar extending landward was found to be heavily eroded. The process of erosion is still going on. □

Anti-fouling Compounds

IN order to develop environment-friendly anti-fouling compounds, the screening of several plants, isolation and chemical characterization of bioactive compounds, bioassay tests and field trials of the compounds were carried out at the National Institute of Oceanography, Goa.

Methanol extract of plant *Derris scandense* exhibited anti-fouling activity against four diatoms and seven species of bacteria, viz., *Navicula subinflata*, *N. crucicula*, *Amphora* sp., *Nitzschia* sp., *Chromatobacterium* sp., *Alkaligene* sp., *Moraxella* sp., *Arthrobacter* sp., *Vibrio* sp., *Pseudomonas* sp. and *Flavobacterium* sp. The concentrations required to inhibit growth varied with the organism, and ranged between 200 and 300 µg/ml for diatoms and 100 and 400 µg/disc for the bacteria. □

Corrosion in Sea

IRON, lead and brass metals were collected from a shipwreck off Minicoy to assess quantitatively their corrosion resistance and behaviour in sea water. Accelerated corrosion test was carried out on these shipwreck metals at the National Institute of Oceanography, Goa. The corrosion rate was found to be highest in the case of iron, followed by lead and brass. The deposition layer on metals consisted of feldspar and chalcocite on brass, ferrous oxide on iron and magnesium carbonate and organic minerals on lead. □

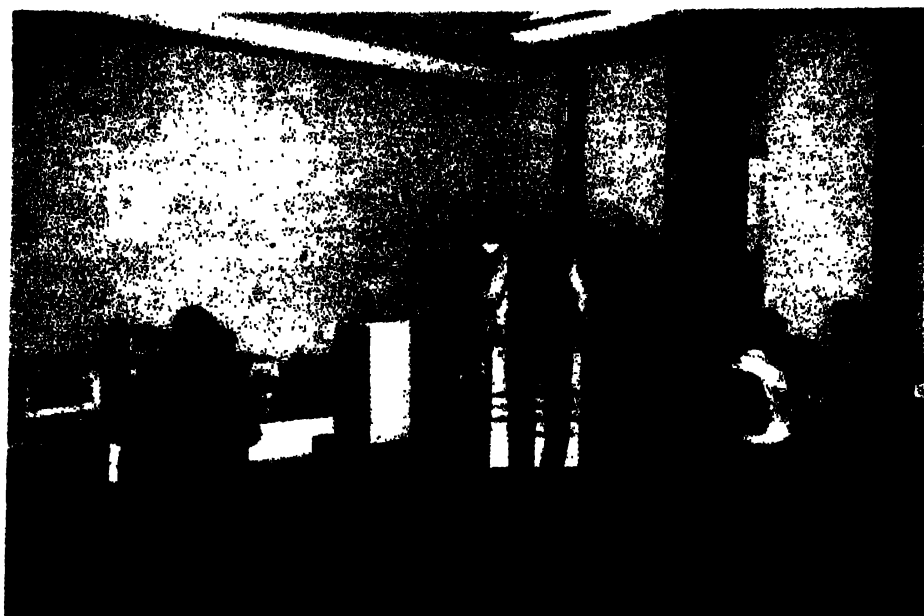
Indian National Scientific Documentation Centre, New Delhi S & T Activities : 1993-94

THE large scale induction of modern information technology in the Indian National Scientific Documentation Centre (INSDOC), New Delhi, during the last five years has enabled the institute to automate most of its information services. This has resulted in an overall improvement in the performance of the institute. Its external cash flow has increased five fold, touching a new peak of Rs 10.54 million during 1993-94. Of this, information serv-

ices fetched a sum of Rs 7.25 million which is four times higher than the 1988-89 figure. A sum of Rs 3.28 million was received from the turnkey projects. The turnkey project income was almost nil about five years ago. Most of these projects have become possible due to the new expertise built up in the fields of library automation, computer networking and database creation.

The commercial exploitation of newly acquired expertise is likely to be the main thrust of INSDOC's activities in the coming years. In addition to the expertise in library automation, database design and development, and computerized networking developed in previous years, INSDOC expanded its skills in two following areas in 1993-94 :

1. Electronic imaging and preparation of CD-ROM databases



A view of electronic library coming up at INSDOC, New Delhi

2. Multimedia technology and applications

Electronic Imaging

The E I technology has emerged as a successful modern alternative to microfiche and microfilm for archiving documents. It facilitates digitization of the paper-based documents and their storage on a CD-ROM of the size of a floppy. The full-text databases are created on CD-ROMs; each disk can store about 300,000 pages of text or 15,000 pages of scanned images. INSDOC has started providing this service as an alternative to micro-filming which is fast becoming an obsolete technology.

Multimedia Technology

INSDOC has acquired expertise to simultaneously process the text, data, graphics, video and audio by computers. It helps in preparing multimedia kits which have become a most powerful tool in the areas of training and education, library and information management. INSDOC has designed and developed software for processing multilingual data and graphics and for merging them for printing pur-

poses. This application of multimedia technology is likely to be used on a large scale for printing jobs and other allied purposes. It is already being used for preparation of photo-identity cards.

New Information Services

Having studied the recent requirements of users, INSDOC decided to have a paradigm shift in information services and identified the following two main areas to be taken up in the first instance:

1. Personal Information Service (PIS)
2. Corporate Information Services (CIS)

The rationale of these services lies in the fact that the information explosion has created a deluge of information material. About 8-10 million information items are generated every year throughout the world in the field of science and technology alone. Individuals and corporate organizations, whose information requirements are very specific, cannot therefore isolate grains out of this mountain of chaff. INSDOC, on the strength of

its resources and expertise, regularly supplies to them the required information in their area of work on a fixed annual subscription. The following four services have been initiated for this purpose:

1. Contents, Abstracts and Photocopy Service (CAPS)
2. Services from Chemical Abstracts
3. Patent Watch Service
4. Global Tender Watch Service
5. Competitor Watch Service

Contents, Abstracts and Photocopy Service

This service has been started to minimize the impact of heavy reduction of subscription to foreign journals by libraries of R & D organizations, universities and colleges. A list of 8,000 core journals has been prepared from which a subscriber to this service can select 30 journals in his area of interest. The subscriber is supplied contents list of the selected journals every month. He can then select articles or papers of immediate relevance and request abstracts or photocopies of full papers from INSDOC on prescribed payment. It is presumed that an individual generally has only one or two articles of close relevance in each issue of a journal. His purpose would be served if he has an access to contents list of the journal issues of his choice backed by supply of photocopy of desired papers. This service is available to individuals at a nominal fee of Rs 400 per annum.

Patent Watch

INSDOC has got access to the world's patent resources and can regularly supply the latest patent documents or latest information about the patents filed in the world, in the area of interest of the subscribers to this service. Patent is

the best source of technological information. Therefore, the service has been started on fixed subscription basis for the corporate industries and commercial houses.

Competitor Watch Service

To provide relevant and adequate information on market opportunities and competitors in business to corporate industries and commercial houses, INSDOC has started a unique service called 'Competitor Watch Service' (see box on page 152).

Global Tender Watch Service

The service has been designed to provide information on invitations to tenders for public contracts, supply contracts, public constructions, advance notices of invitations, service contracts, etc. It is intended for business houses looking for new business opportunities.

Chemical Abstracts Keyword Index Service

The *Chemical Abstracts*, a famous international bibliographic database, contain 80 subsections. The R & D workers generally require only one or two subsections for their consultation purposes. INSDOC makes available the relevant subsections to individuals and organizations at a subscription fee for the service.

In addition to the new services, the traditional services of INSDOC have also registered a significant growth in 1993-94.

Networking

INSDOC has established the Scientific and Industrial Research Network (SIRNET) basically to facilitate a fast computerized communication, data transfer and information exchange among CSIR scientists and their counterparts in other organizations in the country

and abroad. A number of other R & D organizations of the country have also joined SIRNET. It provides facility for placing document copy supply orders at INSDOC and receiving literature search or contents information of select journals output through E-mail. The number of SIRNET nodes have risen to 107 in 1993-94 from 51 in 1992-93. A total of 58,419 E-mail messages were passed on from the network during 1993-94 as compared to 21,012 in 1992-93.

Database Creation

The computerized databases are the most important information resources for any organization. For obtaining literature references on any topic, international databases online or from CD-ROM are generally searched. However, the required information is often not available from such databases. For this purpose, INSDOC is preparing a number of indigenous databases which are ported on INSDOC host system. The databases prepared by other Indian organizations are also ported on INSDOC host system for marketing purposes. The data-

Table 1

S.No.	Database	Organization
1.	National Union Catalogue of Scientific Serials in India (NUCSSI)	INSDOC
2.	Indian Science Abstracts (ISA)	INSDOC
3.	Database of Indian Patents (INPAT)	Patent Unit, CSIR
4.	Medicinal and Aromatic Plants Abstracts (MAPA)	PID
5.	Database of Indian Standards	BIS
6.	Database of Experts	TIFAC
7.	Indian Serials Contents	INSDOC



Experimentation on Multimedia applications in progress at INSDOC, New Delhi

New Services offered by INSDOC

Competitor Watch Service

IN the free market economy, availability of relevant and adequate information relating to market opportunities and on competitors in business is most vital to sustain in today's competitive world. INSDOC has therefore started *Competitor Watch Service* to keep users posted with information on competitors on a regular basis.

Competitor Watch Service provides business competitors with information relating to the performance of a company in the market, its intelligence, finance, joint ventures and other aspects. It offers information on corporate and industry reports, market targets, potentials and opportunities of companies in other countries, etc. Full text of company and industry research reports published by banking firms in the U.S.A., U.K., Canada, Japan and Europe is provided.

Global Tender Watch Service

GLOBAL Tender Watch Service (GLOBTEND) has been designed to provide businessmen,

bases are also made available in part or full on floppies to users. Some of the most important databases ported on INSDOC host system are mentioned in Table 1.

Indian Science Abstracts (ISA) is published every fortnight in hard copy as well. It contains abstracts of research papers published in the Indian journals as well as the research papers published by Indians in foreign journals. It also covers proceedings of conferences/seminars/symposia held in India, monographs and ad-

corporate houses and others access to international tender information electronically or by fax. It provides information relating to invitations to tenders for public contracts from more than 80 countries. The service may be availed of subjectwise. It covers information relating to tenders for public constructions and supply contracts, advance notification of planned invitations to tenders, public service contracts and the results of the invitation to tenders. It has been designed for business people looking for new business opportunities and is the best source of information for public contracts for the corporate sector interested in direct access to documents in their specific fields of interest.

For details, contact:

Marketing and Customer
Services Division
Indian National Scientific
Documentation Centre
14, Satsang Vihar Marg
New Delhi 110 067

hoc reports published by Indian research institutions, Indian patents and standards. It may broadly be called as the mirror of Indian science and technology. In 1993-94, a total of 35,960 articles were processed for inclusion in the database and for publishing in 24 issues of ISA.

Literature Search

Before starting their research work all R & D workers want to know about the work already done in their field of research all around

the world to avoid 're-invention of wheel' and to minimize the wastage of time and labour. INSDOC provides the information to researchers in the country by supplying list of research papers published in the relevant fields.

The list is prepared by searching international databases on CD-ROM acquired by INSDOC and online search of international databases. INSDOC has access to a large number of international databases available with DIALOG, EASYNET, ESA, STN, etc. A total of 513 literature search orders were supplied during 1993-94 as against a total of 414 in the previous year.

Document Copy Supply

INSDOC is the largest agency in the country for satisfying the requirements of photocopies of S & T documents. A total of 19,913 document copy orders were registered and 16,259 supplied during 1993-94 as against 20,927 orders registered and 12,588 supplied during the previous year.

Foreign Language Translations

About 50% of world's S & T literature is published in non-English languages like German, Russian, French, Japanese, Chinese, Spanish. INSDOC provides an efficient facility for translation of these documents into English. INSDOC is the largest agency in the country for providing this kind of highly specialized service. For this purpose, in addition to a number of staff scientists of INSDOC, a large number of specialists are enrolled in a Panel of Translators for undertaking translation jobs from INSDOC. A total of 5938 pages of translations from 18 different foreign languages were supplied to the users in 1993-94.

Training Programmes

INSDOC is contributing to the development of finest trained manpower in the field of information science and technology. It conducts a two-year post-graduate course and awards 'Associateship in Information Science' degree. Besides, a number of short-term courses are organized for the development of skills and capabilities of information/library professionals working in different organizations. A few international organizations like British Council, German Foundation, SAARC Documentation Centre, etc., are regularly sponsoring trainees from developing countries for these courses. The training is offered on the latest equipment and covers latest developments in the field of information science and technology.

Bibliometric Analysis

INSDOC analyzes the research output of scientists on the request of organizations and individuals. The analysis is based on the citation pattern of research papers associated with several factors like impact factor of journals, self-citation, etc. Bibliometric analysis of the research papers of CSIR scientists was brought out in September 1993 in the form of a monograph called *CSIR Research Output 1992*. The document contains analysis of 1471 papers emanating from 30 laboratories. Besides, a bibliometric analysis of 5998 research papers pertaining to 410 individual scientists was also carried out. The analysis included the papers of young scientists, prospective Bhatnagar Awardees and other awardees.

Electronic Library

The massive volume of information generated every year has created problems of storage space, retrieval of required information, and high cost of procurement, management

and handling. To solve these problems, INSDOC has started converting its library into an electronic library. Now, almost all the foreign journals are procured only on CD-ROM discs, whose storage, handling, retrieval of information is extremely easy and the procurement cost is several times less as compared to that of hard copies. It is expected that more and more material will now be available on CD-ROM discs. INSDOC is already procuring about 3500 full text foreign journals on these discs. Any article from the journal can be printed on paper by laser printer almost instantaneously. INSDOC is also planning to convert its existing hard copy material into CD-ROMs through electronic imaging technology. It will lead to the establishment of a full-fledged electronic library at INSDOC. □

Symposia, Workshops & Conferences

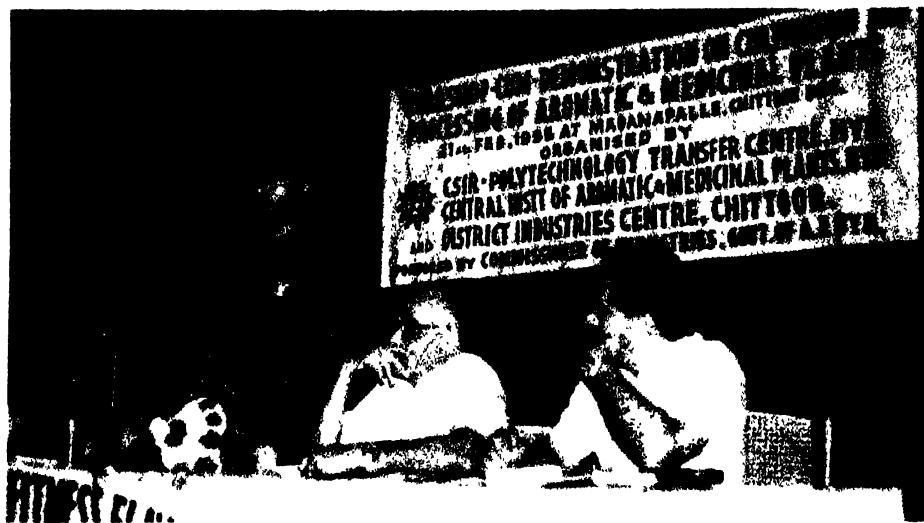
Aromatic and Medicinal Plants

CSIIR Polytechnology Transfer Centre, Hyderabad, in association with the District Industries Centre, Chittoor, and CIMAP Field Station, Hyderabad, organized a one day Workshop-cum-Demonstration Programme for Cultivation and Processing of Aromatic and Medicinal Plants on 21 March 1995 at Madanapally in Chittoor District. The programme was sponsored by Commissioner of Industries, Government of A.P. The main objective of the demonstration programme was to create awareness among the prospective farmers and entrepreneurs about the importance of cultivation of aromatic and medicinal plants which can yield value-added prod-

ucts in Chittoor District as it is climatically suitable for growing aromatic and medicinal plants.

Shri P.K. Valaven, Joint Collector, Chittoor District, was the Chief Guest at the inaugural function. Shri P. Laxminarayana Naidu, the Additional Commissioner of Industries, presided over the function. Shri G.A. Reddy, Project Officer, PTC-Hyderabad, welcomed the participants and spoke about the CSIR and PTC activities for the development of industries in rural areas and explained the programme. Shri Kistappa, Deputy Director, proposed a vote of thanks. More than 150 prospective farmers, entrepreneurs, District officials and representatives of financial institutions participated in the programmes. Shri Valaven while inaugurating the programme appreciated the efforts of the organizers in conducting the above programme for the benefit of prospective farmers and entrepreneurs. These innovative cultivation techniques would yield high value products and also help in setting up industries based on CIMAP technologies. A compilation on CIMAP technologies suitable for Chittoor District was also released. Shri Naidu called upon the prospective farmers and industrial representatives to utilize the innovative techniques/technologies which are available with CIMAP and which can yield value-added products by utilizing the existing agricultural resources. Shri P. Reddy, Joint Director, Agriculture, and Dr Kamla Singh, Scientist-in-Charge, CIMAP, Hyderabad, also spoke on this occasion.

The inaugural session was followed by technical sessions in which three papers were presented: Medicinal and Aromatic Plants by Dr. Kamla Singh, Scientist-in-Charge, CIMAP Centre, Hyderabad; Agro-technologies of



Shri P.K. Valaven, Joint Collector, Chittoor, delivering the inaugural speech. Seated on the dais (from left) are: Shri G.A. Reddy, Project Officer, CSIR-PTC, Hyderabad; Shri P.Laxminarayana Naidu, Additional Commissioner of Industries; Dr Kamla Singh, Scientist-in-charge, CIMAP Field Station, Hyderabad

Important Medicinal and Aromatic Crops by Dr B.R. Rajeswara Rao, Scientist, and Distillation and Processing technologies and Quality Control of Essential Oils by Shri P.N. Kaul, Scientist. The lectures were followed by a T.V. show on CIMAP and its activities. □

Spatially Resolved NMR

THE Human Resource Development Group, CSIR, New Delhi, organized an intensive workshop for CSIR scientists on 'Spatially Resolved Nuclear Magnetic Resonance (NMR)' at the Central Leather Research Institute, Madras, from 13 to 17 February 1995. The objective of the workshop was to focus attention on a rapidly advancing frontier research theme, viz., Nuclear Magnetic Resonance, incorporating spatial information of the sample under investigation.

NMR is a highly developed technique for molecular and biomolecular structure elucidation and is increasingly well-known for this application over the last four decades. Transport measure-

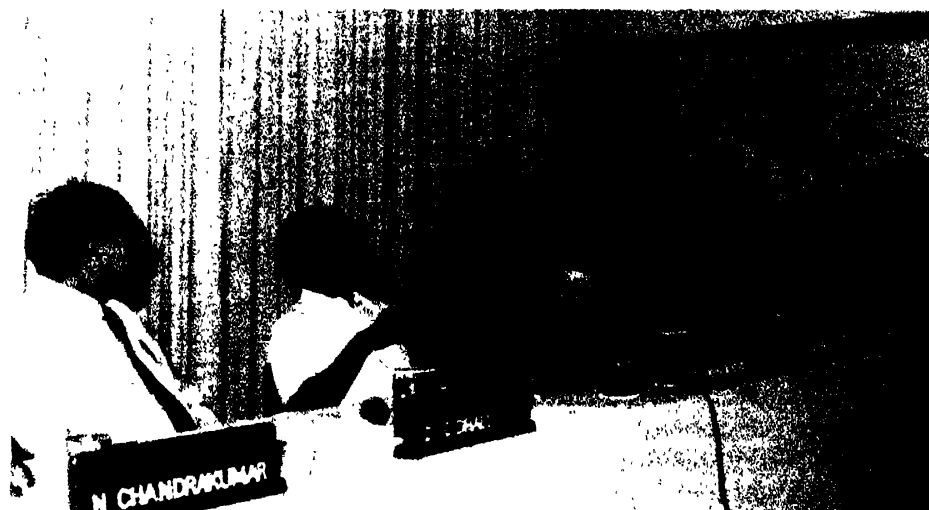
ments by NMR, e.g., the measurement of self-diffusion coefficients, are also known for the last three decades, although far less widely practised. NMR Imaging, on the other hand, is a modality that was developed during the last two decades, primarily for clinical applications.

The incorporation of spatial information in the NMR measurement is, however, of increasing interest in materials science, drug

research and cell biology. It is possible, for instance, to obtain an image of a sample (including a small animal) with resolutions down to five micron level and with the highly informative and distinctive contrast that is unique to NMR. On the other hand, it is also possible to investigate by NMR molecular structure or molecular transport from selected, spatially defined 'regions of interest' (ROI) of the sample.

The NMR microimaging of fluids, NMR microimaging of solids, volume localized NMR spectroscopy and the measurement of self-diffusion coefficients. Shaped pulses and gradient controlled coherence transfer pathway selection in spectral-spatial NMR were also discussed in the workshop.

There were also practical sessions devoted to imaging work and software development at the institute's 300 MHz NMR facility. The workshop was attended by ten scientists from CSIR labs all over the country. Faculty at the program included Magnetic Resonance specialists from the All India Institute of Medical Sciences, IIT-Madras, and CLRI. The workshop was coordinated by Dr N. Chandrakumar.



NMR workshop in progress at CLRI, Madras

mar, Scientist F, Head, Physical Sciences Division, CLRI.

The Physical Sciences Division of CLRI has long been a leading international player in the general area of Magnetic Resonance Spectroscopy and Imaging. The group has made important contributions to Coherence Transfer and Two-dimensional Spectroscopy in the rotating frame to the theory and techniques of liquid state as well as solid state NMR involving spin-1 nuclei (deuterium, lithium-6 and nitrogen-14) and in recent times to Multiple Quantum NMR Micro-Imaging and Spin-Echo-based Diffusion measurements. The group has also contributed an internationally acclaimed monograph on High Resolution FT NMR (N. Chandrakumar and S. Subramanian, Springer-Verlag) and a recent one on Spin-1 NMR (N. Chandrakumar, to be published by Springer-Verlag). □

Watershed Development

A National workshop on 'Watershed Development' was organized under the aegis of Rajiv Gandhi Mission for Watershed Development and CSIR at the Regional Research Laboratory (RRL)-Bhopal during 24-25 February, 1995. The workshop was sponsored by Rajiv Gandhi Mission for Watershed Development, Government of Madhya Pradesh, CSIR; Department of Science and Technology, New Delhi; and Water Management Forum, Ahmedabad.

In his inaugural address Shri Digvijay Singh, Chief Minister of Madhya Pradesh, stressed the need for the participation of farmers and common man to make the schemes viable for the development of rural India. Shri Singh said that public opinion is against the construction of big dams as it



National workshop on 'Watershed Development' in progress at RRL- Bhopal

affects people in large number. Besides, it included massive capital investment for which it is difficult to raise funds. He said that attention should be focussed on the development of small watershed areas instead of constructing big dams.

The needs and requirements of village people should be kept in view while formulating schemes and their participation should be sought. Although farmers are illiterate but their practical knowledge of farming cannot be questioned, he said.

During the technical session of the workshop, discussions were focussed on the following aspects: (i) Scale of the maps to be used for the planning purposes; (ii) Development of data banks; (iii) Survey and investigations; and (iv) People's participation in the development, implementation and operation of watersheds.

The workshop concluded with separate panel discussions by experts and recommendations. These recommendations were broadly in three areas, namely, scientific and technological aspects of implementing the Rajiv Gandhi Mission for Watershed Development, economic development and

people's participation, and management inputs for overall coordination.

There is a need to constantly integrate the efforts of various academic and scientific institutions where a large information and knowledge-base exists in dispersed and diffused state; particularly so with data on hydrological parameters, geology on one hand and expertise in terms of data analysis and interpretation on the other. A problem solving mode will have to be adopted.

The panel on economic development and people's participation underlined the need for a concerted training and development module so that trainers and trainees are in unison with the objectives of the mission. Appropriate representation of local populace in implementation and decision making would have to be ensured. The voluntary sector should be the motivating agency to develop such leadership.

Padmabhushan Anna Saheb Hazare, the doyen of people's participation movement in water management in Maharashtra, called for a dedicated and selfless involvement of voluntary organizations to make this mission a people's move-

ment. Knowledge intensive role of scientists and engineers should properly supplement the mission's objectives. Shri Vilasa Rao Salunke described the Pani Panchayat concept and stressed the need to decipher local knowledge as an input to plan the activities of the mission.

Shri Sunjoy Joshi, Mission Director, Rajiv Gandhi Mission for Watershed Development, briefed about the workshop and made an appeal to all the delegates to participate and support the programmes of the Mission. He complimented Prof. T.C. Rao, Director, RRL - Bhopal, and Dr R.N. Yadava, Scientist EII & Head, Resources Development of RRL-Bhopal and his team for successfully conducting the workshop. □

Termite Control

OF the total wood produced around the world annually, one third is destroyed by bio-degradation. In tropical and semi-tropical countries the destruction by termites is a major factor. According to a survey, expenditure on termite control by India in the

world is second and next to the United States where termites not only eat cellulosic materials but also damage polymers and make passage through cement and concrete. Cyclodiene pesticides which were used till now to control termites are highly toxic and environmentally stable. They are being banned all around the world and the Government of India has also banned them recently.

A National workshop on 'Termite Control' was organized at the Central Building Research Institute (CBRI), Roorkee, during 20-21 February 1995. The main objective of the workshop was to chalk out the strategies for future line of research for non-toxic and environmentally compatible termite control methods. The workshop was co-sponsored by Indian National Science Academy, Department of Science and Technology, Building Materials Technology Promotion Council, Indian Pest Control Association, Hoechst India Ltd, Excel Industries, Bayer India Ltd., Gharda Chemicals, Dow Elanco B.V., Kanoria Chemicals and Searle India Ltd. About 150 delegates from universities, research institutes, public works departments, pest control companies and pesticide manufacturers, etc, attended the workshop. In the workshop 15 special lectures including one keynote address and five short presentations were delivered which were followed by a valedictory session.

In his inaugural lecture Prof. R.N. Iyengar, Director, CBRI, stressed the need for experts from forestry, agriculture, buildings, archeology, defence, railways, etc. to join hands to control the termite menace. He cautioned against the increase in pesticide residues in the environment, including the food chain, in India. However, Prof. Iyengar appreciated the general awareness for eco-friendly ter-

mite control methods and welcomed the experts from various agencies. He suggested that ecological balance in nature should not be disturbed by eliminating termites but efforts should be made towards their control and management. He mentioned that one of the aims of the workshop is to bring together research workers of national labs, university academics and field users on the same platform.

In his keynote address Prof. P.K. Sen-Sarma, Ex-Director, Forest Research Institute, Dehra Dun, dealt with biology, taxonomy and ecology of various termite species. He suggested overall review of conventional termite control methods and suggested studies on termite-repellents, attractants, bio-pesticides, integrated growth regulators, physical barriers and various biological methods. With reference to termite control in buildings, he stressed the desirability of methods having persistence in soil as well as environmental degradability.

In the paper on 'Eco-Friendly Termite Control Measures', Dr Y. Singh of CBRI gave a brief review of work carried out in this direction at CBRI during the last five years. He informed that chlorpyrifos, an eco-friendly organophosphorous pesticide, is approved for soil treatment to control termites in buildings as per recommendations of the institute. Evaluation of Triazophos, Endosulfan and Deltamethrin is in an advance stage. A number of waste materials such as leaves, bark, flowers and seeds from various trees are found to have extractives which show termite repellency. Also, the number of inorganic dusts and granules are being evaluated as physical barriers to prevent termite entry into buildings. Dr Singh also informed about the termite culture facilities in CBRI.



Prof. R.N. Iyengar, Director, CBRI, Roorkee, releasing the proceedings of the seminar on 'Termite Control'

Shri K.K. Unni, Chairman, Association of Basic Manufacturers of Pesticides, Bombay, gave a categorical review of the growth of pesticide industry in India. He welcomed the idea of Integrated Termite Management and assured commitment of the pesticide industry for safe and judicious use of pesticides. Shri Unni spoke about the recent developments in eco-friendly pesticides. Shri R.K. Sharma of Archaeological Survey of India dealt with the deteriorating effects of termites on cultural property. High humidity and dark places accelerate insect activity at Konark site museum. Archival materials such as murals, panel paintings and canvas paintings are highly susceptible to termite attack. Shri Sharma reviewed various chemical and biological methods used for controlling termite attack. He appealed to the delegates to devote special attention to protect monuments from termites.

In his paper 'Termite Problem in Defence - a bird's eyeview' Dr A.P. Srivastava and Dr R.B. Srivastava from DMSRDE, Kanpur, described various problems that arise in defence departments due to termite attack. According to them, ammunition boxes, ropes and most of the cellulosic materials even at high altitudes are damaged by termites. Damage to helipads in remote areas due to termite infestation in soil is also a cause of concern to the Defence Services. Shri A. Azeem from RDSO, Lucknow, reported that Indian railways too suffer from termite damage. He expressed concern about the damage of railway tracks due to termite infestation in soil.

Dr R.V. Verma, Scientist, Kerala Forest Research Laboratory, spoke about the work of his laboratory on the control of termites in eucalyptus plantations. In his paper on 'Botanical Insecticides' Prof. K.C. Gupta of Pantnagar Agriculture University highlighted the potential of plant extractives in

controlling termites. Prof. S. Basalingappa of Karnatak University, Dharwad, gave a review of biological methods of termite control. Shri H.N. Mishra, Head, Timber Engineering Branch of Forest Research Institute, Dehra Dun, described various structural measures to control termites in buildings. Dr Balamani Bezbaruah of Regional Research Laboratory, Jorhat, described the work on wood preservation and biopesticides. Dr G. Shankar of Rallis India and Shri S.S. Arora of Kanoria Chemicals spoke on effectiveness of Fenavebrate and Lindane for this purpose. Dr Brajendra Singh of the Directorate of Plant Protection, Quarantine and Storage, Faridabad, spoke on the regulatory requirements in the use of insecticides in termite control. Prof. D. Rajagopal of University of Agriculture Sciences, Bangalore, spoke on the ecology of termites. Dr B.S. Attri from the Ministry of Environment and Forests, New Delhi, emphasized the need of integrated approach to control termites and assured the support of his Ministry for this purpose.

The following recommendations were made at the workshop: (1) The current practice of indiscriminate use of pesticides in the buildings should be avoided due to possible health hazards and persistence in the eco-system. Attention should also be paid to avoid contamination of underground water and to protect soil flora; (2) Scientists working on different aspects of termite control should co-ordinate their efforts and CBRI, Roorkee, may act as the nodal point for this purpose; (3) Linkages with SAARC and Pacific countries on research and training in the area of eco-friendly termite control methods would be useful; (4) Systematic research work should be started for identification of the species of termites that cause damage,

their biology and ecology. Engineering studies on termite mounds and mathematical modelling of growth of termite population should be undertaken; (5) CBRI may consider conducting training programmes for termite control operators to make them conversant with scientific methods.

All the lectures delivered in the workshop have been published in book form under the title *Termite Management in Buildings*. □

Medicinal Plants in Skin Care

A two day National seminar on the use of the traditional medicinal plants and an exhibition on the herbal products were held at Central Institute of Medicinal and Aromatic Plants (CIMAP), on 25-26 November, 1994. The seminar was inaugurated by Prof. S.K. Joshi, Director General, CSIR. Stressing upon the need for further research and development in this area, Prof. Joshi said that internationally there exists tremendous marketing possibilities for Indian herbal products. Need of the hour is to make quality products out of domestically grown plant material. Some of these products should be for export and others for domestic market. Prof. Joshi further stressed upon the collaborative programme between institutes, industries and marketing organizations. Prof. Joshi emphasized that Lucknow enjoyed a unique position of having four CSIR laboratories, two dealing with plants, one with drug development and the other with toxicology. He pointed out that it presented an excellent opportunity where all the components - cultivation, formulation, drug development and toxicology - can be taken care of at one place under one active collaborative programme among the local CSIR laboratories. Delivering the key-

Training Programme

Fire Retardant Thatch Roof Technology

TO improve the quality of life of the poor in rural areas of the country, Central Building Research Institute (CBRI), Roorkee, in collaboration with the Council for Advancement of People's Action and Rural Technology (CAPART), New Delhi, organized two training programmes on 'Fire Retardant Thatch Roof Technology', during 28 February-2 March and 7-9 March 1995.

Forty participants belonging to various agencies of different states, Tamil Nadu, Andhra Pradesh, Assam, West Bengal, Orissa and Uttar Pradesh, participated in the training programme. Hands-on training was imparted to the participants. Later, the participants prepared the fire retardant thatch roof panels and



Trainees erecting a thatched roof during the training programme on 'Fire Retardant Thatch Roof Technology' conducted by CBRI, Roorkee

tested the efficacy of the technology. The participants were also introduced to other CBRI technologies appropriate for rural housing and environment. The technologies were non-erodable mud plaster, plinth protection for mud walls, frameless door/win-

dow shutters, prefabricated brick panel system for roofing, stone masonry blocks for walling, waste water disposal system and two pit sanitary latrines.

The participants were awarded certificates by the Director, CBRI, Roorkee. □

note address Dr P.N. Behl, Director, Skin Institute and School of Dermatology, New Delhi, stressed upon the need for keeping the body healthy. Prof. Behl explained the use of various traditional plants in skin care such as chamomile, comfrey, fennel, rosemary, basil bay, lavender, mint, jasmine, cucumber, lemon, bringraj, nutmeg, henna, neem, etc.

Earlier, Dr Sushil Kumar, Director, CIMAP, welcomed the guests and delegates and briefly dwelt upon the work done on medicinal and aromatic plants in the institute. He informed that the institute has initiated a project for herbal formulations using indigenous raw material. On this occasion, Mrs Hema Joshi inaugurated an exhibition of products related to

skin, hair, nail and dental care, wound-healing and anti-ageing. She also released a book *Medicinal Plants in Skin Care*. On this occasion representatives from indus-

tries, scientists and small scale manufacturers and other connected with herbal products' industries participated in deliberations. □



Smt. Hema Joshi inaugurating an exhibition of herbal products at CIMAP, Lucknow



Dr E. Desa, Director, NIO, and Dr S.Z. Qasim, Member, Planning Commission, participating in the workshop on NIO - Sponsors Interactions

NIO-Sponsors Interactions

A one-day workshop in NIO-Sponsors Interactions was organized at the National Institute of Oceanography (NIO), Goa, on 29 March 1995. The workshop was intended to provide a common platform for industries/sponsoring agencies to have open dialogue to help NIO provide better services to various agencies concerned. The workshop was attended by the Managing Directors and senior executives of various reputed industries and other agencies.

Dr S.Z. Qasim, Member, Planning Commission & Chairman, Research Council of NIO, spoke on 'Ocean Industry and Emerging Areas'. In his lecture he highlighted the uniqueness of NIO as an R&D organization which caters to the needs of ocean industries. He stressed the need for a greater awareness of the expertise available and assessment of emerging areas to understand the global competition. He also indicated that there is a possibility of gearing a part of the institute along industrial lines to enable it to bid for global tenders for turnkey projects.

Shri B.S.J. Swamy, General Manager, Reliance Petroleum Ltd, Bombay, while lauding the expertise developed by NIO, suggested that this institute should play an advisory role in totality and assist the industries with all inputs from the planning stage. There was also a suggestion to draw up MoUs between industries and NIO so that projects relating to the ocean sector are taken up without any formalities.

Dr D.N. Rao, Vice President, (Projects), Tata Chemicals Ltd, Mithapur, suggested that NIO should popularize mariculture technique and also prepare curriculae for such courses to be introduced at the college or university level.

Earlier, Dr Ehrlich Desa, Director, NIO, spoke on the objective of holding such workshops and the important role that industries can play in utilizing the R&D outputs of CSIR labs for the country's development. Dr A.B. Wagh appraised the contract and consultancy projects that are being carried out by the institute and Dr N.M. Anand proposed a vote of thanks. □

New Publications

Green Gene

EVIDENCE from the Middle and Far East shows that humans started growing crops some ten thousand years ago. This was followed by domestication of animals for food, transport and tillage. Man also exploited microorganisms for producing bread, fermented foods and drinks, without understanding the processes involved. Initially, in the absence of the understanding of the basis of heredity and variation, the improvements in crops and animals following their domestication were slow.

The structure of DNA — the genetic material determined in the mid-fifties — is regarded as the most significant development in life sciences. This was followed by the deciphering of the genetic code. These discoveries laid the foundations of molecular biology. The applications of the knowledge and techniques of molecular biology for the improvement of microbes, plants and animals is now widely recognised as biotechnology. Recombinant DNA techniques have made it possible to introduce and express the genes of choice from any living organism in the desired microbe, plant or animal.

Classical genetics and manipulation of genes at the cellular level have played a major role in enhancing the productivity of plants and animals. The molecular manipulations of the genetic material are likely to play an even greater role towards increasing the efficiency of microbial, plant and animal production systems. Genes for fixation of atmospheric nitrogen have been transferred to microbes other than those naturally endowed with them. Environmentally friendly microbes, blue green algae, mycorrhizae and earth worms are being used to increase soil fertility.

Green gene is a lucidly written and lavishly illustrated book that provides fascinating glimpses into a future made hunger free by the yeoman service rendered by scientists manipulating the 'green gene'. The book is sixth in the series of the Publications & Information Directorate's popular science monographs 'Vistas in Biotechnology' brought out under the DBT sponsored project on Dissemination of Biotechnological Information.

Author: Dr Shakuntala Bhattacharya, pp 102, Rs 20 (paperback) + postage Rs 2

Gene Power

RAPID advances in our understanding of the life processes have taken place in the past few years. The discovery of the double helical structure of deoxyribonucleic acid (DNA), the cracking of the genetic code, development of the recombinant DNA and PCR techniques, and the elucidation of the three-dimensional structure of proteins have added to the current excitement in molecular biology. These discoveries have greatly enhanced our understanding of the molecular basis of life and have provided a variety of new techniques which are finding increasing applications in agriculture, medicine, diagnostics, forensic science and industry. These techniques have made it possible to move genes between microbes, plants and animals and express them. Human proteins can now be produced by genetically engineered microbes, animals and even plants. There are distinct possibilities of correcting the defective genes in humans by gene therapy.

Common molecular principles and structures underlie the diverse forms of life. From *Escherichia coli* to man living organisms share the same genetic

code and many other common features at the molecular level. The flow of genetic information from



DNA to RNA to protein is also essentially similar.

Classical genetics and manipulation of genes at the cellular level have played a major role in enhancing the productivity of plants and animals. These manipulations were, however, limited to the utilisation of the primary gene pool. The molecular manipulations of the genetic material are likely to play an even greater role towards increasing the efficiency of microbial, plant and animal production systems of the future. The genes available in the global biodiversity can, in principle, be transferred and expressed in the species of choice. It is necessary to have a clear understanding of the discoveries made in the field of molecular biology for appreciating how these ideas can shape our lives in future.

Gene Power is a lucidly written and profusely illustrated book that tells us about the ground work that had to be done before cells revealed genetic secrets. It details the cellular activities of the mole-

cule of life and throws light on how these are manipulated in human interest by scientists who have learnt to harness gene power.

The book is the eighth in the series of the PID's popular science monographs 'Vistas in Biotechnology' brought out under the DBT sponsored project on Dissemination of Biotechnological Information.

Authors: Prof Asis Datta and Dr Sudha Bhattacharya, pp 108, Price Rs 20 (paperback) postage Rs 2

Orders for these publications should be accompanied by Money order / I. P. O. / Demand draft/Cheque, made payable to 'Publications & Information Directorate, New Delhi', and sent to: The Sales & Distribution Officer, PID, Dr K.S. Krishnan Marg, New Delhi 110012. □

Deputation Briefs

R.N. Basu

DR R.N. Basu, Scientist 'C', CGCRI, Calcutta, was deputed to Germany as a DAAD fellow under CSIR-DAAD exchange programme for 19 months. The period also included four months compulsory German language course.

Dr Basu carried out research work on High Temperature Ceramic Superconductors, particularly in the area of oxygen ordering and accurate determination of the oxygen content of $YBa_2Cu_3O_{7.8}$ system at the Physikalisches Technische Bundesanstalt (PTB), Braunschweig, under the guidance of Prof. D. Schiel. During his stay he also attended two international seminars and visited Max Planck Institute (MPI), Stuttgart. □

Printed and Published by Dr G.P. Phondke, Director, Publications & Information Directorate (PID), Dr K.S. Krishnan Marg, New Delhi - 110 012
Printed at PID Printing Unit

Editors : Dr B.C. Kashyap, Dilip M. Saini and Madhu Sahni

Phone: 5786301

Gram: PUBLIFORM

Production : Kamal Kishore

Telex: 031-77271

RN 4512/57

Annual Subscription : Rs. 60
Single Copy: Rs. 3.00

E-mail: pid@sinetd.ernet.in.

Fax: 5787062

CSIR

NEWS



VOL 45 NO 11 15 JUNE 1995



Carbon fibre experimental production plant in operation at National Physical Laboratory, New Delhi (top). Industrial braids made from carbon fibre (bottom).

IN THIS ISSUE

Carbon Fibre Technology	162	National Geophysical Research Institute, Hyderabad	
Diode Cathode for Microwave Tubes	163	R & D Highlights: 1993-94	165
AC Drive for Electric Vehicle	164		
Human Resource Needs in R & D Institutes	169	International Symposium on Lube-base Stocks	171

Carbon Fibre Technology

NATIONAL Research Development Corporation (NRDC), New Delhi, has licensed the National Physical Laboratory's technology for manufacture of carbon fibre for braiding applications to a Bombay firm. At a function held on 2 May 1995 at NPL, New Delhi, Shri N.K. Sharma, Managing Director, NRDC, and Prof. E.S. Raja Gopal, Director, NPL, handed over the technology knowhow documents to Shri Raj Kumar Pandey, Managing Director, Machining Centre India Pvt. Ltd (MCI), Bombay, in the presence of Shri Ashok Parthasarathi, Additional Secretary, Department of Scientific and Industrial Research, Government of India, New Delhi, and Shri Y.S. Rajan, Executive Director, TIFAC and Adviser, Department of Science and Technology, Government of India, New Delhi. Carbon fibre gland packings are the latest state-

of-art materials used in piping networks of chemical, nuclear and other plants. The knowhow for this technology developed at NPL uses indigenously available raw material, i.e., Polyacrylonitrile (PAN). Carbon fibre is the most technically advanced and cost-effective successor to asbestos as gland packing material due to its low coefficient friction, anti-corrosive nature and resistance to high temperature. With the availability of these gland packings indigenously, the industry at large will be benefitted in terms of reduced down time and increased non-stop plant operations.

MCI is setting up a 5 tonne per annum semi-commercial plant in Bombay at a total cost of Rs 13.1 million. The project is being financed jointly by NRDC, Technology Information Forecasting and Assessment Council (TIFAC) and

MCI for upscaling the laboratory scale knowhow. Financial assistance to the tune of Rs 4 million is being provided by TIFAC and Rs 2 million by NRDC in the form of Technology Development Loans. After successful completion of the semi-commercial plant, MCI proposes to set up a full scale commercial plant of 100 tonnes per annum capacity. MCI has already commercialized NPL technologies on flexible graphite and PAN fibre.

Today, carbon fibres are finding large scale applications in engineering, biomedical and industrial sectors. This is because of their unique characteristics such as high specific strength and modulus, light weight, resistance to corrosion and high thermal conductivity. In fact, carbon fibres are stronger than steel and lighter than aluminium. Additionally, carbon fibre is not 'a material' but a family of materials. There are several grades of carbon fibres available commercially to meet the requirements specific to each sector of application. These find applications in strategic areas like nose tips for missile, leading edges for lighter aircraft, nose cones, etc. The superior quality brake linings for all modern and supersonic aircraft today are made from carbon fibres. These brake linings are 3-5 times better in performance and more reliable than the conventional ones used earlier. In view of the strategic applications of this material, G-7 countries have put an embargo on the export of carbon fibres to the Third World countries like India.

To make carbon fibres available in the country, Carbon Tech-



Prof. E.S. Raja Gopal, Director, NPL, and Shri N.K. Sharma, Managing Director, NRDC, handing over the 'Carbon Fibre Technology' transfer documents to Shri Raj Kumar Pandey, Managing Director, Machining Centre India Pvt. Ltd, Bombay

nology Unit of NPL has made concerted efforts in this area resulting in the development of carbon fibres technology for industrial applications in the country for the first time. These carbon fibres find large scale consumption in the form of braidings in many industries where environment is hostile to health of the workers. Moreover, carbon fibre braidings are an ideal substitute for asbestos-based braidings which have proved to be a health hazard. Asbestos has been found to be carcinogenic and its use has been banned in all the developed countries. The carbon fibres developed at NPL additionally find large scale applications as structural material for building in the form of carbon fibre reinforced concrete, electromagnetic interface shielding material for aircraft, weaving shuttles for looms in the textile industry, mechanical gears, etc.

According to a recent market survey report of NRDC, the net foreign exchange savings by using indigenously manufactured carbon fibres will be around Rs 50 million. Development of this critical technology in the country using indige-

nous raw materials is a landmark which will open new areas of application of this grade of carbon fibres and the demand will go up many folds in the coming years to come. Technology Information, Forecasting & Assessment Council (TIFAC) and National Research & Development Corporation (NRDC) are also promoting this critical technology under "Home Grown Technologies Mission". □

R & D Flashes

Dispenser Cathode for Microwave Tubes

A batch of Type-M cathodes has been developed by the Central Electronics Engineering Research Institute, Pilani, for DRDO/DLRL, Hyderabad. These cathodes give zero field emission density of $7\text{A}/\text{cm}^2$ at 1050°C against the user's requirement of $6\text{A}/\text{cm}^2$ for some specific applications.

Detailed electrical and thermal measurements carried out on these cathodes indicate that CEERI cathodes are quite close to

imported ones with similar specifications. □

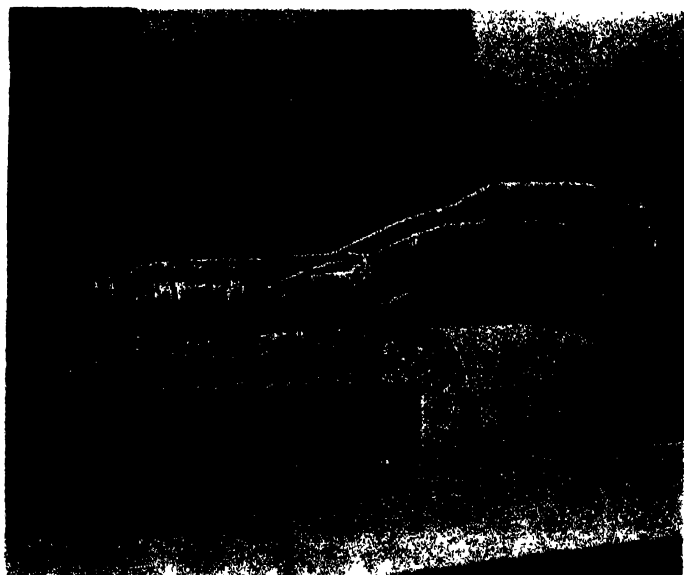
Fine Line Technology for Hybrid Microcircuits

A new technology for fabrication of ultrafine line thick film hybrid microcircuits has been developed by a scientist of the Central Electronics Engineering Research Institute, Pilani, while working in Germany. It makes use of the laser ablation technique. $0.002''$ line width and line to line spacing can be achieved by this technology.

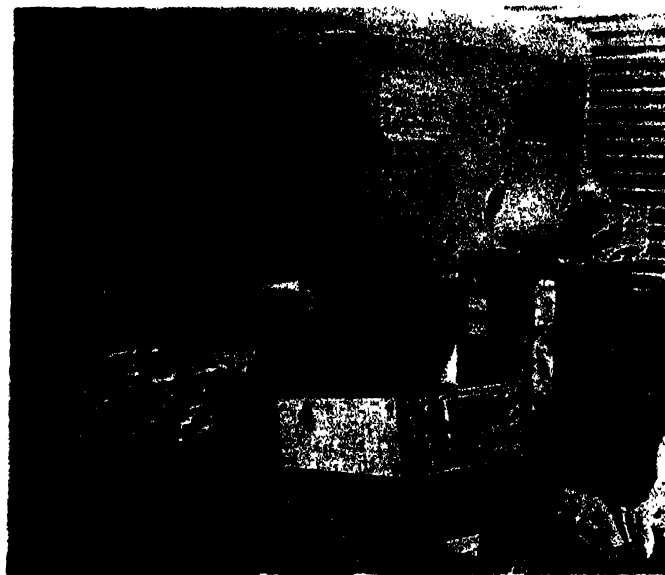
A patent entitled 'Improvements in and related to the production of hybrid microcircuits and printed circuit boards' has been filed in the above area. □

PWM based Rudder Control Actuator

PWM amplifier unit for electromagnetic actuator for rudder control was developed by the Central Electronics Engineering Research Institute, Pilani, for Aero-



Dispenser cathode under test



Battery operated electric vehicle

naval Development Establishment, Bangalore, who approved it after extensive testing. Four more units have now been fabricated. □

AC Drive for Electric Vehicle

A transistorized PWM drive unit for electric vehicle has been developed by the Central Electronics Engineering Research Institute, Pilani, which has met the required specifications. This unit has been fitted in a jeep for extensive field trial. The drive technology used is AC induction motor drive system. This is the first time in India an AC drive system has been tried out. The entire system, including the control logic, operates on a 120 V battery bank mounted inside the jeep. □

Space Quality Metallized Substrates

TECHNOLOGY of metallized alumina substrates has been developed by the Central Electronics Engineering Research Institute, Pilani. These substrates have met space qualification tests. Metallization involves sputter coated chromium-gold followed by gold electroplating to increase the thickness to the desired value. The laboratory can supply few of such substrates to user agencies. □

Microwave performance of Ku Band Down Converter measured at SAC

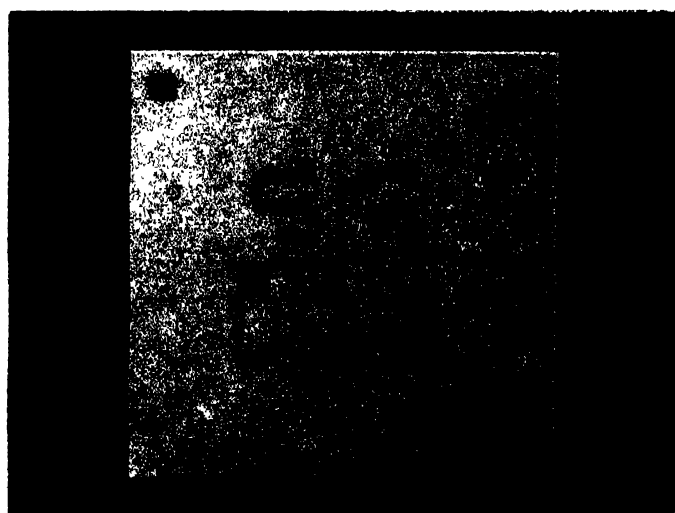
Parameters	Specifications Targetted	Specifications Achieved
Input frequency (GHz)	14.25-14.5	14.25-14.5
Output frequency (GHz)	11.45-11.7	11.45-11.7
Low frequency (GHz)	2.8	2.8
Nominal low power (dBm)	+7	+7
Conversion loss max (dB)	13	12
Inband spurious at -40 dBm 1/P (dBc)	-60	-60

Electro-optical specifications of photodetector at 25°C and $\lambda = 1.3 \mu\text{m}$

Parameters	Test conditions	Min	Type	Max
Breakdown voltage	$I_D = 1 \mu\text{A}$	25	50	70
Dark current	$V_{\text{reverse}} = -6\text{V}$		5	25
Capacitance	$V_R = -6\text{V}$, $f = 1 \text{ MHz}$		0.5	0.7
Responsivity	$V_R = -6\text{V}$		0.6	
Quantum efficiency	$V_R = -6\text{V}$		60%	

Ku Band Down Converter

SPACE Application Centre, Ahmedabad, has been supporting the development of active and pas-



Ku band down converter



Top view of InGaAs/InP PIN photodetector with four different photo-sensitive areas

sive microwave devices for the last several years at the Central Electronics Engineering Research Institute, Pilani. Under this programme, a Ku band down converter module consisting of a Lange coupler, mixer circuit, input/output filters, has been fabricated using the air

bridge technology, and has been space qualified.

InGaAs/InP PIN Photodetector

INGAAS/INP Pin Photodetectors with state-of-the-art electrooptical specifications have been de-

veloped by the Central Electronics Engineering Research Institute, Pilani. These devices find applications in the receiver front ends of long haul high bit rate optical communication systems. The detailed specifications of the fabricated chips are given on page 164. □

National Geophysical Research Institute, Hyderabad R & D Highlights: 1993-94

THE geophysical research is directly related to (i) Knowledge-providing insight and understanding into the structure, composition and dynamics of the earth's interior; (ii) Economy- exploration of mineral and energy resources and (iii) Safety- study of natural calamities/catastrophes and environmental degradation. The last one brings geophysics directly to the people as its objectives are to quantitatively characterize, assess, mitigate and try to predict the natural hazards like earthquakes, cyclones, landslides, floods, droughts, etc. The R&D programmes at the National Geophysical Research Institute (NGRI), Hyderabad, encompass all these aspects of geophysical science. Many of the programmes are supported/sponsored by the various organizations. The number of such projects during 1993-94 was 32, the total cost of which works out to be Rs 53.234 million. Of this amount, Rs 18.22 million were received during this year.

An account of major activities of the institute during 1993-94 is presented here:

In the wake of tragic Latur earthquake of 30 September 1993 in Maharashtra a major thrust of the institute's research studies concerned the Latur region. With a moment magnitude M_a 6.1, this calamity is now rated as the worst

Stable Continental Region (SCR) earthquake in terms of loss of human lives. At the same time it is also extremely intriguing since it occurred quite unexpectedly in the hitherto presumed stable shield area of peninsular India and thus forced geoscientists to have a 'second look' at the shield and mount detailed field evaluation of the tectonic and other causative factors responsible for this earthquake.

After the initial phase of studies in the Latur region to characterize the basic earthquake parameters, NGRI launched a multifaceted study consisting of gravity, magnetotelluric, geohydrological, geochemical, seismic, structural, etc., activities. The purpose is to infer an integrated model of deep structure to assess the possible factors for the unsuspected release of energy. These field investigations have led to certain very interesting findings along the surface rupture and adjoining areas. The aftershocks were found to be mostly shallower than 4 km and restricted within a small area of about 5 km radius. Other important results include deduction of a very high H_e anomaly near surface ruptures, and a low velocity and high conductivity zone at hypocentral depths. The institute also coordinated and supported field studies conducted by various expert teams from China, Germany, France and the United Nations. A

concurrent increase in the level of seismic activity in the Koyna-Warna region also kept the seismic recording team and instruments fully engaged in the required monitoring.

The processing of the field data for the oil industry (ONGC) continued on institute's Cyber system. On the basis of extremely encouraging correlation between the interpretation of the MT data collected by NGRI and data from the deep drilling by the ONGC, it is realized and agreed by both sides that a more detailed and integrated geophysical survey of the Saurashtra peninsula should be undertaken for mapping the hidden sedimentary formations in this region. For this, discussions on an integrated project proposal of mutual interest continued with the OIIB and ONGC. Other efforts to actively interface with the industry



Structural bands in granitic gneiss

Expertise and Facilities at NGRI

THE National Geophysical Research Institute, Hyderabad, has expertise and facilities for Research and Development in the field of: Aerial Geophysical Exploration, Seismics, Electrical & EM Exploration, Geothermics, Gravity and Magnetism, Geohydrology, Geophysical Instrumentation, Mineral Physics, Rock Mechanics, Palaeomagnetism, Geochemistry, Helium Emanometry, Geochronology, Geostatistics.

In addition to qualified staff, the institute has the following facilities: ICP and Mass Spectrometer lab, XRF lab, Electron Microprobe, Tritium lab, Petrology lab, Cyber 180/850A Mainframe Computer, 3100/40, Microvax and Apollo workstations, Seismic and Magnetic Ob-



Electron probe micro analyzer

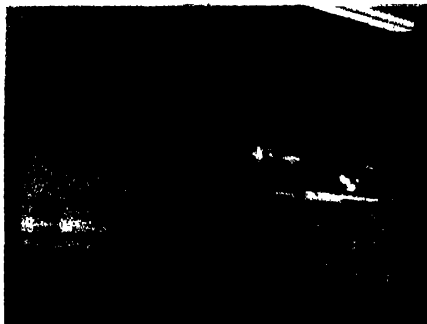
servatories, Mineral Separation lab, Petrology lab, Hydrofracturing Unit.

The NGRI has the capability and knowhow to take R&D studies in the following areas:

- **Technologies for Natural Resource Exploration:** Reflection and Refraction, Seismic, Elec-

trical, IP, EM, VLF, MT, Magnetic, Gravity, Scintillometric, Helium-emanometry, Geothermal and Geochemical exploration for oil, groundwater, gold, coal, diamond and other minerals and geothermal resources

- **Interpretation of Geophysical Data:** Modelling, processing



Mass spectrometer-VG 903

and inversion of data including seismic data for all kinds of explorations

- **Airborne Geophysical Surveys:** Multiparametric aerogeophysical (including helicopter borne) surveys
- **Marine Geophysical Surveys:** Magnetic, gravity, seismic and bathymetric surveys in off-shore regions
- **Groundwater Management and Studies on Pollution of Ecosystems:** Assessment of groundwater resources and modelling of complex aquifer systems for their hazard-free optimal management. Field investigations and modelling for disposal sites and migration of pollutants
- **Engineering Geophysics:** Civil engineering and mining applications such as bedrock and tunnelling, power

plant siting, and rippability studies in mines

- **Instrumentation:** Design and development of geophysical instruments; maintenance of various geoscientific equipment
- **Deep Crustal and Lithospheric Structures:** Imaging through seismic soundings, magnetotelluric, gravity and geothermal investigations
- **Seismicity:** Monitoring, modelling and zoning of seismically active regions; hazard assessment and quantification of reservoir induced seismicity
- **Modelling of Earth System Processes:** Modelling of various physico-chemical geoprocesses on different scales



Stable isotope laboratory

- **Surveys in Antarctica:** Geophysical surveys to characterize subglacial basement geology, structure and tectonics and paleore construction

For more details contact: The Director, National Geophysical Research Institute, Uppal Road, Hyderabad 500 007. □

this year includes advanced data processing of gravity and magnetic field observations involving 1500 stations for the Hindustan Oil Exploration Corporation (HOEC).

The multifaceted problems of groundwater in different terrains of the country continued to be pursued with vigour. It is being tackled in the 'mission mode' under the technology mission programme of the Ministry of Rural Development, Government of India. Integrated investigations were carried out in the Kengal basin (A.P.), Palar river basin (Tamil nadu), Devagarha (Orissa).

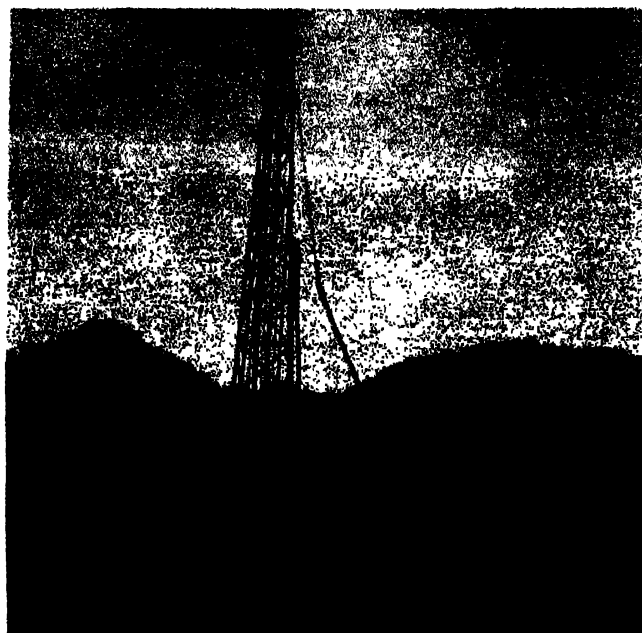
A study demonstrated that due to strong heterogeneity of the hard rock region, the existing notion of 'recharge' and 'discharge' may have to be suitably revised. From field experiments in Rajasthan, it has been shown that by using a 'polymer treater' surface derived enhancement in the run-off is achievable.

Data on distributions of the stress and displacement fields in Himalaya and adjoining regions were compiled using a finite element algorithm. The results analyzed in light of seismicity of the region suggest that the stresses are built up above the upper surface of the subducting Indian lithosphere. In the NE region of the country, continuous running of 59 stations was completed successfully and a seismic wave velocity model was inferred. Spectral analysis of the dolomite abundance data indicated presence of a 23-24 m.y. periodicity. Interpretation of conspicuously low values of gravity field over the Laxmi ridge in the Arabian sea suggested a large scale underplating of low density material.

In the high grade terrains, at least two episodes of granulite grade metamorphism were recognized on the basis of structural

studies in the Dharwar craton of the Indian shield. Existence of long lived enriched subcrustal mantle reservoirs has been interpreted at the Hogennakal and Sasthur carbonatite complexes. From the Sm-Nd dating of layered igneous complexes of Honnur Cauvery suture, new age data have been obtained. In case of high grade terrain, a very fine scale and gradual mineralogical transition has been identified. Peak metamorphic (P,T) conditions have been deduced for: (a) metasediments of Madurai, (b) metapelites of Mannaparai, and (c) granulites of Narthamalai and Siramalai. Sharp contact and concordant relationship is observed between the granites and gneisses of the Munchungpet-Rudrakote sector of the Eastern Ghat belt. The charnockite terrain is inferred to be upthrust block against the gneiss. Possibility of post formation crustal anatexis processes are indicated in certain areas.

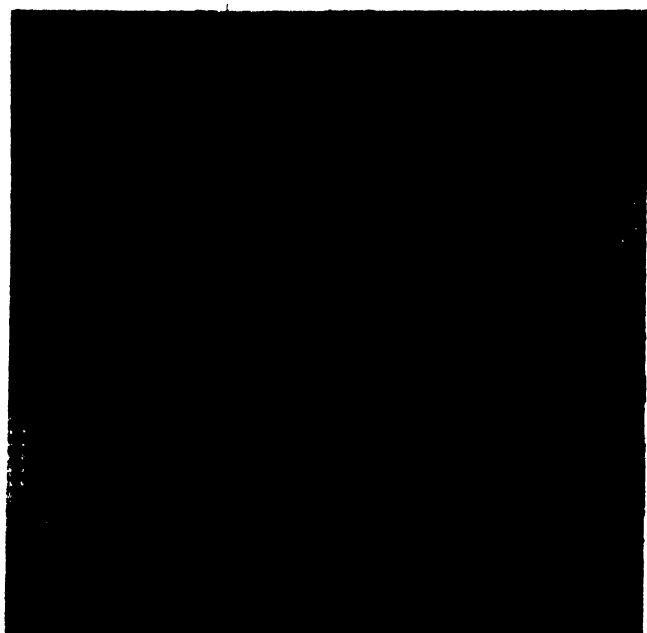
From the thermomechanical model studies, certain areas of stress concentrations were delineated beneath the Deccan trap region, which may have implications for the seismic activity observed in the Koyna and Latur regions. A phenomenon of 'compound chaos' has been identified and an eugenic algorithm for global optimization developed. In the field of geothermics, active contacts have been established with various agencies with a view to utilizing the available deep holes for an extensive heat flow coverage of the country. On the basis of a 3-D basement relief map prepared from the grav-



Deep seismic field operations in progress

ity observations, a 5-8 km thick sedimentary section is deduced in the central part of the Pranhita-Godavari sub-basin. In the Killari region, an interesting finding from gravity data is the indication of block movement which could be significant with regard to earthquakes in the region. A significant 3-D anomaly over the Shillong plateau, delineated by the NGRI's aeromagnetic group, has been confirmed by the AMD Ground followup. A major magnetic heterogeneity has been inferred at 5-6 km depth in the Mahanadi basin. The Palaeomagnetic Group has identified a reversal in the Rajmahal traps during the Cretaceous normal super. The Marine Research Group has identified magnetic anomalies characterizing sea floor spreading in the central part of the Bay of Bengal that allow the construction of the evolutionary history of this part since break up from Antarctica.

Among the sponsored activities, continuation of DST project on Jaipur-Raipur transect forms a major theme. During the year, MT and gravity profile was carried out



Gravity contour map of Central India

in the Central India with a view to delineating the expected suture zone between Bundelkhand-Satpura on the north and Bhandara craton in the southern side.

The data acquisition and advanced processing/interpretation along two segments of the Nagpur-Kunjar profile was nearing completion. The analysis carried out so far shows the presence of a conspicuous domal shaped reflector at 6-8 TWT suggesting crustal shortening and lateral variation in transparency and/or reflectivity of the upper and lower crusts (including Moho) along the profile.



Air borne pulse EM sensor

Other seismological studies include synthetic seismograms prepared by extensive modelling of elastic and absorbing media. A useful insight has been gained, for the first time, into the hidden layer problem. A new approach has been developed to interpret coincident seismic refraction/reflection data sets for obtaining both velocity structure and 2-D modelling.

By combining the wide angle refraction/reflection data with the available deep well data from Jaguli-1, certain layers have been inferred deep below the Bengal basin and interpreted to be extension of Rajmahal traps and Gondwana sediments.

Based on a seismic tomography study of the Godavari and Krishna basins, a low velocity zone (indicative of high temperatures in the lithosphere) has been identified which could be due to significant thinning during evolution of the eastern margin and subsequent reactivation.

The institute's programme relating to exploration of the natural resources have led to a number of useful results such as ground-wire source transient electric field data which allow defining of a laterally heterogeneous buried resistive layer. On the basis of MT field investigation, a well defined highly conductive zone has been delineated at shallow depths beneath the Killari region. The geoelectrical structure across the central India shear zones has been mapped. It is found that a range of T-R separa-

tion could be estimated for a given parameteric combination which gives optimal resolution. In seismic exploration work simulation of SH wave has been done and an empirical approach has been found to convert P-wave velocity logs into S-wave velocity logs. A fractal separation method is gainfully used for processing of seismic reflectivity.

The institute has been an active participant in the rational programmes on Antarctica and IGBP. During the year, the geological samples of biotite gneisses and leucogneisses brought from the Schirmacher area of Antarctica were dated and yield ages of 853 ± 51 Ma and 773 ± 26 Ma respectively. Under CSIR's IGBP programme investigations were carried out to understand the evolution of carbon isotopes and $^{87}\text{Sr}/^{86}\text{Sr}$ ratio in planktonic foraminifera during past 1 m.y. The downcore measurement on samples show high ratio which is indicative of enhanced glacial weathering in the Himalaya-Tibet region. Analysis of saline water in the coastal region is indicative of post-Pleistocene marine transportation.

NGRI is one of the participants in an interlaboratory programme on Indian reference material which comes under CSIR's thrust area on 'Standardization, Metrology and Quality System'. During the year, mercury and selenium reference materials were prepared.

Two international workshops, one on 'Groundwater Monitoring and Recharge in Semi-arid Areas' and the other on 'Earthquake Resistant Non-Engineered Buildings' were held at the institute during the year. □

Symposia, Workshops & Conferences

Human Resource Needs in R&D Institutes

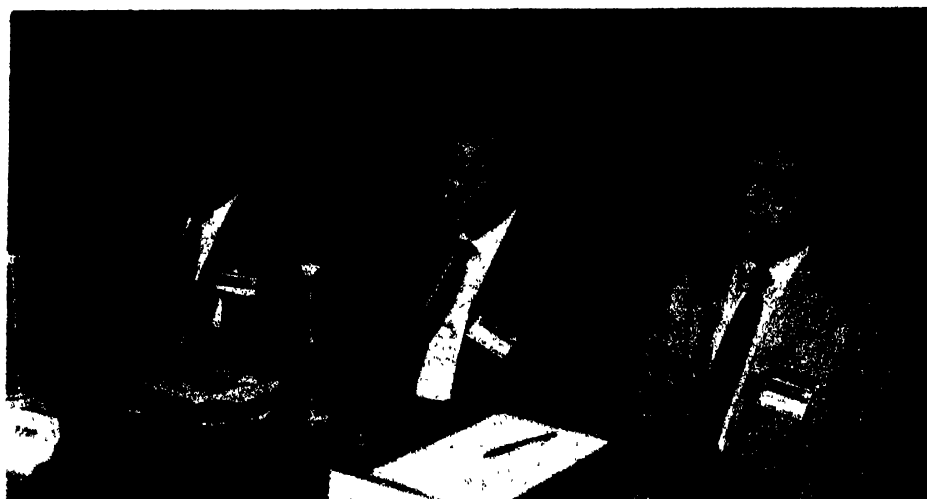
THE present day society is confronting many challenges in the face of globalization process. One of the most daunting challenges is the question of human resource development, particularly in the Third World countries. As a step in this direction attention is focussed on the interface between R & D and industry. A matter of special concern to World Association of Industrial and Technological Research Organizations (WAITRO) is the manner in which they are being compelled to restructure and adopt new approaches to meet the changing environment caused by the economic and industrial restrictions throughout the world. Realizing the crucial importance of human resource development for R & D in the emerging world conditions, WAITRO, in collaboration with the National Institute of Science, Technology and Development Studies (NISTADS) and Shriram Institute of Industrial Research (SRI), New Delhi, recently organized an international seminar on 'Human Resource Needs for Change in R & D Institutes', in New Delhi. The focus of discussion at the seminar was on issues related to personnel development, quality management and new mechanism for institutional development pursued by R & D institutes in various countries. The seminar was attended by about 100 participants from Asia, Africa, Latin and North Americas, Europe and West Indies. There were about 40 Indian participants. The participants were high and middle level policy-makers, plan-

ners, decision makers, R & D managers and research scientists representing national R & D agencies and institutes and industries. Welcoming the delegates, Dr Niels Nielsen, Acting President of WAITRO, mentioned that challenges are mainly of two types. Firstly, there is a growing demand for RTOs (Research and Technology Organizations) as part of the infrastructure of all countries competing in the global economy. Secondly, RTOs are required to prove their own efficiency in the market. The RTOs cannot prioritize their own activities on R & D perspectives alone but have to become market and customer driven. Dr Nielsen emphasized that to meet these challenges human resource development is a crucial management task.

In his address, Dr Bansil Dhar, Chairman & Managing Director, DCM Industries, stated that the pace of change in technology is today mind-boggling. The dynamics of technology is now organized around information and its rapid transmission rather than mechanical or any other form of energy used in the last two decades.

Technology literacy is thus only one aspect of the changes. A greater challenge is to understand technology and its dynamics, the opportunities it offers and its impact on usable products, market, organization structures and people. In this context, he said that WAITRO has been playing a notable role in energization of RTOs throughout the world and establishing international cooperation in the field. He described briefly the activities of SRI which is among the most successful private R & D institution in India. The value of commercial production from processes developed by SRI is more than Rs. 3 billion. Its success is attributed to its keeping a sharp focus on vital markets realizing relevant technologies that can best serve the potential users.

In his Presidential address, Prof S.K. Joshi, Director General, CSIR, mentioned that there is a worldwide movement to make national economies and trade respond to global competition. Mastery over management of technology is a key element in this endeavour. For this purpose, human resources of appropriate back-



International seminar on 'Human Resource Needs for Change in R & D Institutes' in progress. Seated on the dais (from right) are: Shri M.A. Qureshi, Scientist, National Institute of Science, Technology & Development Studies; Prof. S.K. Joshi, Director General, CSIR; and Dr C.N.R. Rao, President, Jawahar Lal Nehru Centre for Advanced Scientific Research

ITRC signs MoU with Lucknow University

INDUSTRIAL Toxicology Research Centre (ITRC), Lucknow, has signed a Memorandum of Understanding with Lucknow University (LU), Lucknow, on 6 April 1995. The MoU was signed by Dr R.C. Srimal, Director, ITRC, and Prof. M.S. Sodha, Vice Chancellor, Lucknow University, Lucknow, in presence of Dr V.P. Kamboj, Director, Central Drug Research Institute, Lucknow, and other senior scientists from the institute and the university. According to this MoU, ITRC and LU would mutually to share their facilities, expertise and database. The MoU includes: (1) research students working at ITRC will be permitted to register for the award of Ph.D. degrees of LU. An ITRC research student will have two guides, one

each from LU and ITRC; (2) Ph.D. students working at Lucknow University will be allowed to carry out part of their work at ITRC for a maximum period of two months, and ITRC will provide necessary laboratory facilities and expert guidance; (3) On request from LU, ITRC will conduct short-term training courses for students of B.Sc. (final year) and M.Sc (first year) of the University; up to a maximum of five students will be acceptable and paid pocket allowance as per ITRC norms; and (5) ITRC and LU will explore and conduct joint/collaborative research projects for their mutual benefit and advancement of basic and applied research. □



Seen on the occasion of signing the Memorandum of Understanding between Industrial Toxicology Research Centre and Lucknow University (from left): Dr. R.C. Srimal, Director, ITRC, Prof. M.S. Sodha, Vice-Chancellor, Lucknow University, Dr V.P. Kamboj, Director, CDRI and other senior scientists

ground and training would be needed to manage the transition. CSIR has adopted a three-pronged

strategy to utilize its research results and capabilities, which comprises: (1) re-orienting R & D

programmes to industrial needs; (ii) forging linkages with constituents of the innovation chain; and (iii) effective management and marketing of R & D knowledge base. He mentioned that the impact and success of CSIR can be gauged only by what is deployed in the production of economic system. CSIR is strengthening its in-house design and engineering capabilities. It has forged alliances with National Small Scale Industries Corporation and Asian and Pacific Centre for Transfer of Technology (APCTT) to offer services and inputs of technology sources' information, technology evaluation and assessment, technology generation, equipment leasing, marketing and export. Other recent initiatives are the national programme for development of new drugs recently mounted with CSIR as the nodal agency and the national mission on enhancing the level of quality and exports of leather industry through technology upgradation from tanning to product designing and manufacture. Each CSIR laboratory has set up a Business Development and Marketing Unit. Decisions on business development and contracts have been decentralized to the level of laboratories. Scientists in CSIR are no more confined to an ivory tower. In fact, they are becoming conscious of the client's needs of quality, time and confidentiality.

In his Inaugural address, Dr C.N.R. Rao, President, Jawahar Lal Nehru Centre for Advanced Scientific Research, Bangalore, expressed his concern about the government R & D institutions losing R & D personnel of calibre continuously and at a rapid pace. Today, maintaining the scientists' calibre has become a difficult task for institutions. As compared with a university professor or a young engineer who is an R & D manager with a diploma in management in a private institution, the scientist

engaged in Government R & D is poorly paid. There is an urgent need to maintain hopes and aspirations of S & T personnel engaged in Government R & D institutions. In the changing socio-economic scenario, setting goals in R & D institutes is very important. Quality and excellence must be ensured while recruiting and managing S & T personnel. He said that bureaucracy is a hurdle in the way of attracting and retaining bright S & T personnel in R & D institutes. He observed that major R&D achievements are never planned. Excellent and bright scientists must therefore be supported for creative R&D work. He emphasized that along with liberalization of economy, other aspects of life should also be liberalized to nurture quality.

The participants unanimously agreed upon a number of issues which need to be attended to on priority basis for sensitizing R & D institutes to the global changes, particularly the widespread emerging forces of market economy. The first need is the enhancement of the capabilities of R & D institutes for commercialization of research results. It requires restructuring of research organizations and creation of conditions in which R & D and management personnel feel easy to cooperate for achieving the goals of the organizations. Secondly, it is imperative to respond to consumer needs and competition in global economy. The R & D institutes must therefore keep themselves abreast of current knowledge in science and technology. Scientists and technologists need encouragement for interaction at the international level to have access to real time availability of knowledge. Thirdly, resource availability for training of scientists and technologists of developing countries in developed countries is limited. Also, the cost of training has increased to pro-

hibitive levels. Over the years, the developing countries have developed reasonable R & D facilities. It would therefore be better if the donors take up the training programmes in developing countries themselves. In this way, the cost of training would be less and a larger number of local personnel would be trained. Finally, as lack of availability of funding to R & D institutes in developing countries is a serious bottleneck for adequately responding to the challenges of liberalization and market competition, it is high time that R & D institutes in these countries are provided liberal financial support. □

Lube-base Stocks

AN International symposium on 'Production and Application of Lube-base Stocks' was organized recently by the Indian Institute of Petroleum (IIP), Dehra Dun, in New Delhi, to provide a common forum to scientists/researchers, refinery engineers/lubricant manufacturers, marketing companies, additive suppliers and lubricants users to

deliberate on the recent developments in the area and exchange experiences with a view to identifying likely directions that need to be pursued in R & D labs to improve process/plant operations and making available base stocks and additives which, when formulated into a finished lubricant, meet the present day and future engine's requirements. The symposium was attended by 350 delegates including 35 from USA, UK, France, Germany, Singapore and other countries.

Inaugurating the symposium Captain Satish Sharma, Minister of State for Petroleum & Natural Gas, said, "Our effort is to augment oil production from our existing fields while at the same time adding to reserves through exploration in India and abroad". Speaking about the role of the downstream sector of the oil industry, particularly lube-base stocks, in improving fuel efficiency on the one hand and promoting fuel conservation on the other, Capt. Sharma observed that for market the lubri-



Capt. Satish Sharma, Minister of State for Petroleum and Natural Gas, inaugurating the International symposium on 'Production and Application of Lube Base Stocks' held in New Delhi

cants had become increasingly international. He said that in India with the decanalisation of most of the petroleum products, including lubricants, entry of a large number of international lube marketing companies such as Shell, Caltex, Mobil, Total, Elf and several others had ushered in a competitive regime which he hoped would result in manufacture and marketing of much better products. Referring to the various initiatives and policy measures taken by his Ministry to open up the hydrocarbon sector to the winds of competition and change, he said, "We have freed the economy from bureaucratic and physical controls and are committed to giving full play to entrepreneurial initiative."

Regarding the refining industry in the country, Capt. Sharma said that today our refining capacity, after revamps and expansions, stands at around 53.4 million tonnes per annum of which the production of lube-base stocks is a little over half million tonnes.

By the end of the century, the demand of petroleum products is expected to be around 100 million tonnes, wax and lubricants accounting for between 5 and 1.8 million tonnes, he added. He said that the current emphasis in the refinery sector is on manufacturing imported quality base oils from advanced process technologies, nearly independent of the quality of these crudes.

Speaking on the occasion Shri G.V. Ramakrishna, Member, Planning Commission, and Chairman, National Organizing Committee, said that two more lube refineries were being set up during the Eighth Plan to help reduce imports. These refineries to be put up by Bharat Petroleum and Hindustan Petroleum are at various stages of clearance from the Central Government, he added.

Prof. S. K. Joshi, Director General, CSIR, urged the petroleum industry to spare more funds for R&D activities. The annual budget of the Indian Institute of Petroleum, the premier research unit, is hardly Rs 50 million while the turnover of the oil industry in the country around Rs 400,000 million.

The keynote address 'New Perspectives in Production and Application of Lube-Base Stocks' was delivered by Prof. M. M. Sharma, FRS, Director, University Department of Chemical Technology, Bombay. The symposium was dedicated to the memory of Late Shri Lovraj Kumar. His widow, Smt Dharma Kumar, released the proceedings of the symposium. Earlier, Dr.T.S.R. Prasada Rao, Director, IIP, and Chairman, Technical Committee of the symposium, welcomed the chief guests and other dignitaries. Dr. Himmat Singh, Organizing Secretary of the symposium, pointed out that the domestic production of lubes was around 0.4 million tonnes against the demand of more than 1 million tonnes per year.

The technical presentations were spread over three days and consisted of eight invited papers from experts on the subjects of relevance to the theme of the symposium. Oral and poster presentations of 40 contributory papers were followed by panel discussions on the aspects discussed in the sessions. The technical presentations were grouped under the following four sessions: (a) Technological advances in production of lube oil base stocks; (b) Compositional parameters of lube oil base stocks, their significance in processing and lubricant performance; (c) Lube oil base stocks—properties, additive response and their interrelationship; and (d) Synthetic and environment friendly base fluids for lubricants.

The valedictory address was given by Shri S.N. Mathur, Director (Production), HPCL - Refinery, Bombay. □

Crude Oil Evaluation

A two-day workshop on 'Challenges in Crude Evaluation with Changing Crude Scenario' concluded on 6th April 1995. The workshop was attended by 110 delegates from all refineries of India and research and planning organizations in the petroleum sector from all parts of the country. The workshop was inaugurated by Shri Kuldeep Chandra, OSD, KDMIPE, Dehradun, and the keynote address was delivered by Dr A.K.Bhatnagar, Executive Director, Indian Oil Corporation (IOC), R&D Centre, Faridabad. Eighteen invited lectures were delivered by experts from research and industry and planning organizations. The deliberations in various sessions covered different aspects of crude oil evaluation, viz., Indian crude scenario and crude processing; changes in product quality and product specification in the light of environmental considerations; analytical developments in the area of crude oil and product analysis; implications in heavy crude processing and analytical challenges in analysing these crudes to help overcome the handling and processing difficulties. Computerization in the management of analysis and analytical data was also highlighted.

Shri A. Unnikrishnan, a member of the Oil Coordination Committee, gave an overview of the indigenous and imported crude oil processed in the country and the criteria for the allocation of crude oils to different refineries based on the process units available and product demand. Shri M.K. Joshi from the Process Group of EIL presented a paper describing the vari-

ous crude processing schemes and requirement of crude evaluation data.

Dr J.M. Nagpal of Indian Institute of Petroleum, Dehradun, presented a critical comparison of crude quality from various indigenous fields in eastern region, western region, Bombay off shore and new fields in Cauvery basin and Godavary basin and a typical crude imported mix from Middle East. In his paper, Shri R.L. Sharma of IIP highlighted the quality of Jodhpur crude oil from Rajasthan sector, which is very heavy crude with high sulphur content, while other Indian crudes are low sulphur-bearing. A large amount of data generated by IIP in the area of crude oil evaluation has been compiled on computer. Dr A. K. Saxena of IIP gave information about this database.

Shri T.G. Kulkarni from Oil India Limited highlighted the flow related problems of waxy crudes while Dr S. Kapoor of ONGC talked about flow behaviour of non-waxy heavy crude. Dr Balraman of Madras Refineries Ltd. discussed the characteristics of heavy crudes and their possible instrumental analysis. Shri H.V. Lodhia of Gujarat Refinery discussed the processing problems related to the processing of heavy crudes.

At the end of the workshop, a panel discussion was organized. The panel discussion was coordinated by Dr G.C. Joshi, Scientist Emeritus, CSIR. Other panel members were Shri Sudhir Singhal, Area Coordinator, IIP; Dr J.M. Nagpal, Organizing Secretary; Shri T.G. Kulkarni, Dr Balraman and Shri Y. Kumar. The major recommendations, which emerged after the panel discussion, include: (a) Availability of crude data at minimum time and cost is of vital importance. Some central agency like OCC or CHT should coordinate. A spectrum of indigenous and im-



Workshop on 'Challenges in Crude Oil Evaluation with Changing Crude Scenario' in progress at Indian Institute of Petroleum, Dehradun

ported crude oils should be selected for which IIP could carry out evaluation studies and make the data available; (b) All refineries and R&D centres should join hands to update the instrumental analysis facilities to meet the new challenges in heavy crude characterization and changing product specifications; (c) Besides acquiring valuable data through traditional crude evaluation procedures, there is a need to look deeper into the fractions for value addition to the streams so that profitability of the refineries could be increased; (d) There is a need for a more detailed study of chemistry of heavy crude oils to tackle the various problems related to heavy crude handling and processing; and (e) A cooperative research programme should be undertaken by refineries having FCC, hydrocracking, visbreaking and other secondary conversion processes for predicting yield and quality to increase profitability of using the secondary conversion facility.

Research efforts made by IIP in the area of crude oil evaluation was applauded by the delegates. Shri Sudhir Singhal informed the participants that IIP has most modern infrastructure and the facilities are being further updated

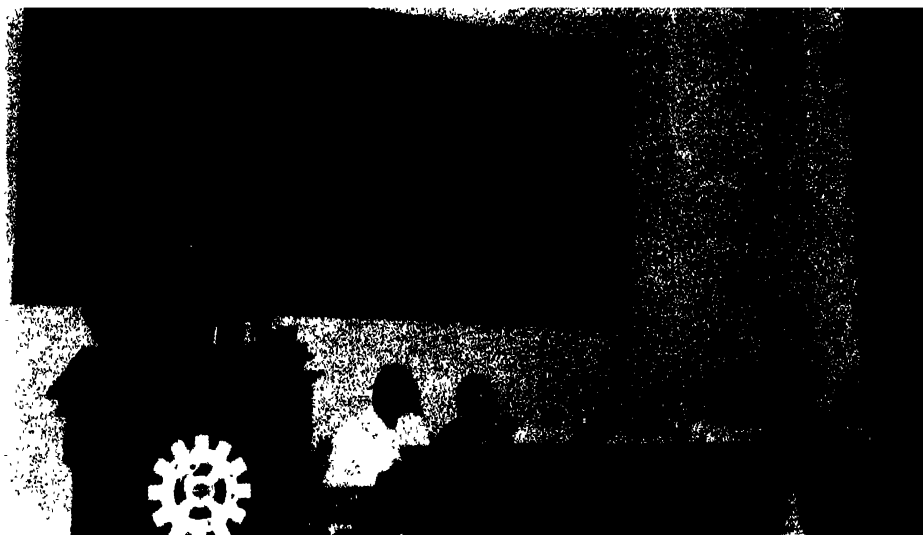
through OIDB grant to meet the future challenges in the areas. Dr J.M. Nagpal proposed a vote of thanks. □

Foundation Day Celebrations

IIP

THE Indian Institute of Petroleum, Dehradun, celebrated its Foundation day on 22nd April 1995. Dr Vijay L. Kelkar, Secretary, Ministry of Petroleum and Natural Gas, was the Chief Guest who delivered the Foundation Day lecture 'Reforms of the Hydrocarbon Sector - Emerging Perspectives' at the institute's auditorium. The lecture was attended by distinguished personalities from the oil industry, dignitaries from the various R&D organizations in Dehradun and staff members of the institute. In his lecture Dr. Kelkar outlined the role of hydrocarbon sector, the pressing reasons for its reforms and the possible content of its emerging reform process.

In 1991, when the Government introduced its new economic, fiscal and trade policy, Dr Kelkar said, the first phase of the policy was



Foundation Day celebrations in progress at Indian Institute of Petroleum, Dehradun

stalwarts of the oil companies who were present on this occasion. He said that the Foundation Day was an occasion to remind IIP scientists and technologists challenges facing the oil sector. He gave a brief history of IIP and talked about the great progress made by the institute in the last five years, including the development of technologies for single-step oxidation of cyclohexane to adipic acid and Sulfolane production. He also said that the emphasis of IIP would now shift in view of the reforms in the hydrocarbon sector.

In his Presidential remarks, Prof. M.M. Sharma, FRS, felicitated all the IIP members and said that it was time to think of making the "foundation stronger" in the petroleum industry which aims to "produce more from less". He said that the modern life style critically depends on the petroleum industry which the IIP serves. He emphasized the need of changing heavier fractions to more useful ones, and of the changes in downstream processing. He said that Indian scientists have been successful with the aromatics but now unique catalysts, separation processes and engines have also to be attended to.

The proceedings of the Foundation Day function were conducted by Dr K.S. Jauhri, who also proposed a vote of thanks. □

CFRI

THE Central Fuel Research Institute (CFRI), Dhanbad, celebrated its Foundation Day on 22 April 1995. Prof. Rajendra Kumar, Department of Chemical Engineering, Indian Institute of Science, Bangalore, delivered the Fortyninth CFRI Foundation Day lecture. He gave a brilliant exposition on the frontiers in chemical engineering and its importance in high technology utilities. Prof. S.K.

right on track and the rate of growth accelerated to 5 %. The second phase would include the non-tradeable sectors, e.g., telecommunications, transport, finance and energy sector, and the third phase would cover the factors of production when privatization would take place.

Talking of the 'tradeable' and 'non-tradeable' sectors, Dr Kelkar emphasized that as a part of a larger group of the energy sector, the hydrocarbon sector was unique in that it was internationally tradeable sector amongst the entire energy industry and served as a cushion or swing sector. The consumption of hydrocarbons would go up from 8.0% to 10% per annum to ensure more dynamism of the Indian economy. The role of hydrocarbons in the transitional period in the energy scene, i.e., transition from coal to hydrogen, is very important.

Dr Kelkar also talked about the necessity of reforming the system of subsidies as they have become unsustainable now. Citing the example of ONGC, he said that it was getting half the international price for the oil it produced. He also said that another shortcoming of Indian oil industry is that it does not ade-

quately satisfy the consumer demands. The hydrocarbon sector needs to reform itself to ensure the country's economic security as it has become 'frontline' sector of the national economy.

He warned of an impending oil crisis in the coming years. He estimated that the total gains through the reforms of the hydrocarbon sector could be to the tune of Rs 15,0000 million. All the aforementioned factors, he said, justify the need for immediate reforms.

Talking of the 'pricing reforms in oil sector', Dr Kelkar said that there is a need to enhance efficiency. He said that as ONGC is the largest Indian oil company, its reform is the key to the reform of the whole oil industry of the country. Regarding the methodology of the reforms, Dr Kelkar pointed out that it should come from within. Concentration on core competence, greater decentralization, greater power or freedom to the management of the organization and greater interaction within the oil industry would be the major components of reform.

Earlier, Dr T.S.R. Prasada Rao, Director, IIP, welcomed the Chief Guest, the members of the Scientific Advisory Committee, other

Joshi, Director-General, CSIR, presided over the meeting. In his address Prof. Joshi congratulated and complimented CFRI for its improved performance over the last three years and particularly during 1994-95. He gave the institute a place among the top few CSIR laboratories which are earning more than 33% of their total expenditure. Bringing out the importance of coal in future primarily to meet our energy requirements, he urged the institute to do even better. CFRI, he said, is perhaps the oldest of CSIR laboratories which came into being within the CSIR family. Among the distinguished persons present on the occasion were Dr S.K. Gupta, Chairman, CFRI Research Council and its members Dr R.N. Sharma, Adviser, TISCO, formerly Chairman, Coal India; Prof. R. Natarajan, IIT, Madras, Prof. V. Mahadevan, IIT, Kharagpur; and Prof. H.S. Ray, Director, RRL (Bhubaneswar). Shri K. Raja, Deputy Director, CFRI, proposed a vote of thanks.

Prof. Joshi inaugurated the newly constructed CIBORIUM (a hall-like structure supported on pillars and not fully covered on sides) in the CFRI Quadrangle. Dr Gupta presided over the meeting. Dr Kotur S. Narasimhan, Director, CFRI, welcomed all present on the occasion. He declared that the CIBORIUM has been named Visvesvaraya CIBORIUM to honour Bharat Ratna M. Visvesvaraya, the statesman-engineer. Prof. Joshi spoke at length on the current policies and industrial background of the country so that CSIR laboratories could also meet the challenges ahead. He was happy to note that CFRI was already geared to meet such challenges through its Strategic Plan and also through many other activities aimed at restructuring and redefining the importance of its projected goals. He reiterated that CFRI as the eldest



Prof. S.K. Joshi inaugurating the Visvesvaraya CIBORIUM in presence of Dr. S.K. Gupta and Prof. R. Kumar



Dr Kotur S. Narasimhan welcoming the visitors on the CFRI Foundation Day. Seated on the dais (from left) are : Prof. S.K. Joshi, Prof. R. Kumar and Shri K. Raja

in the family should emerge as an ideal laboratory for others to emulate. He also released a new brochure *CFRI At Your Service* meant to attract more clients for the institute.

Dr. Gupta said that extra efforts were particularly needed in the coal sector as the industrial growth rates in steel and power

were comparatively much higher. Dr Narasimhan presented silver plaques to honour Prof. Rajendra Kumar, Prof. S.K. Joshi and Dr S.K. Gupta on behalf of Director and staff of CFRI.

Shri Samir Sen, Head, Technical Information, CFRI, proposed a vote of thanks. □

Shoe Testing Lab receives Accreditation

UNDER the aegis of National Leather Development Programme, shoe testing facilities of international class were recently commissioned at the Central Leather Research Institute's Shoe Design and Development Centre (SDDC) by Mr Sydney Palmer, Deputy High Commissioner of U.K. at Madras, in the presence of Dr R.E. Whittaker, Chief Executive, Shoe and Allied Trades Research Association (SATRA) of U.K. More than 70 tests conducted by this laboratory are accredited by the SATRA and will be accepted worldwide. The laboratory has been set up with US \$0.5 million funding from UNDP and Rs 5 million counterpart funding from CLRI/CSIR. More than 150 clients have availed the new facilities during the last six months. More than 100 samples per month are now being tested at the centre. □

Shoe Sole and Mould expertise offered

THE Indian shoe exporters mostly employ soles imported from Germany, Italy, U.K. and other developed countries. In recent years, Indian component manufacturers have started production of unit soles within the country based on imported designs and moulds from Italy, Germany, U.K., Taiwan, Korea, Portugal and Spain. Few companies have started mould fabrication for their captive consumption. Some cottage or small scale level mould manufacturers with-

out much engineering and design expertise are providing sub-standard moulds to the domestic market. The experts from Central Leather Research Institute, Madras, and UNIDO specialists made a detailed survey of the country's shoe sole mould scenario and recommended to the National Leather Development Programme to support the development of CLRI's expertise in this area.

A sole mould design group has already been formed. It has started providing technical services to the industry. A detailed project report has been prepared to set up a shoe sole mould design and production centre in private sector. At present the Shoe Design and Development Centre of CLRI is the only institution in India offering these specialized services. The first CLRI designed shoe sole mould is expected to be released soon through a sponsored project funded by M/s Farida Shoes, Ambur. □

CLRI offers Accreditation Facilities

FOR propagating and sharing the expertise gained in the following specialized fields, the Central Leather Research Institute, Madras, offers accreditation facilities to interested users:

- Modular training programme in leather, footwear, leather garments and goods
- Shoe testing (in house quality control/monitoring and international quality assurance)
- Benzidine and arylamine assessment in leathers □

Honours & Awards

CRRI

THE Central Road Research Institute, New Delhi, has been awarded the 'Road Safety Media Award' by Automobile Association of Upper India, New Delhi, for the magnificent contribution made to promote road safety in the country. The Award was given to Dr. S.M. Sarin, Head, Environment and Road Traffic Safety Division, and his team. □

D.V.Singh and Y.R. Phull

PROF. D.V. Singh, Director, Central Road Research Institute, New Delhi, has been awarded Commendation Certificate by the Highway Research Board of the Indian Roads Congress for his valuable contributions as the Convenor of the 'Identification, Monitoring and Research Application Committee' during the period 1991-93. Shri Y.R. Phull, Dy. Director, CRRI, has also been awarded the Commendation Certificate for his valuable contributions as the Member-Secretary of the Committee. The Awards were presented during the 144th Council Meeting of the Indian Roads Congress held at Ooty in May 1995. □

Vineeta Singhal

SMT. Vineeta Singhal of the Publications & Information Directorate, New Delhi, has been awarded first prize for her article 'AIDS — *Kya Kabhi Milega Chhutki*' for 1994 by Hindi Vaidyanik Sahitya Parishad, Bhabha Atomic Research Centre, Bombay. The prize carries a cash award of Rs 1,500. □

Printed and Published by Dr G.P. Phondke, Director, Publications & Information Directorate (PID), Dr K.S. Krishnan Marg, New Delhi - 110 012
Printed at PID Printing Unit

Editors : Dr B.C. Kashyap, Dilip M. Salvi and Madhu Sahni

Production : Kamal Kishore

Annual Subscription : Rs. 60
Single Copy: Rs. 3.00

Phone: 5786301

Gram: PUBLIFORM

Telex: 031-77271

E-mail: pid@aimsl.emet.in.

Fax: 5787062

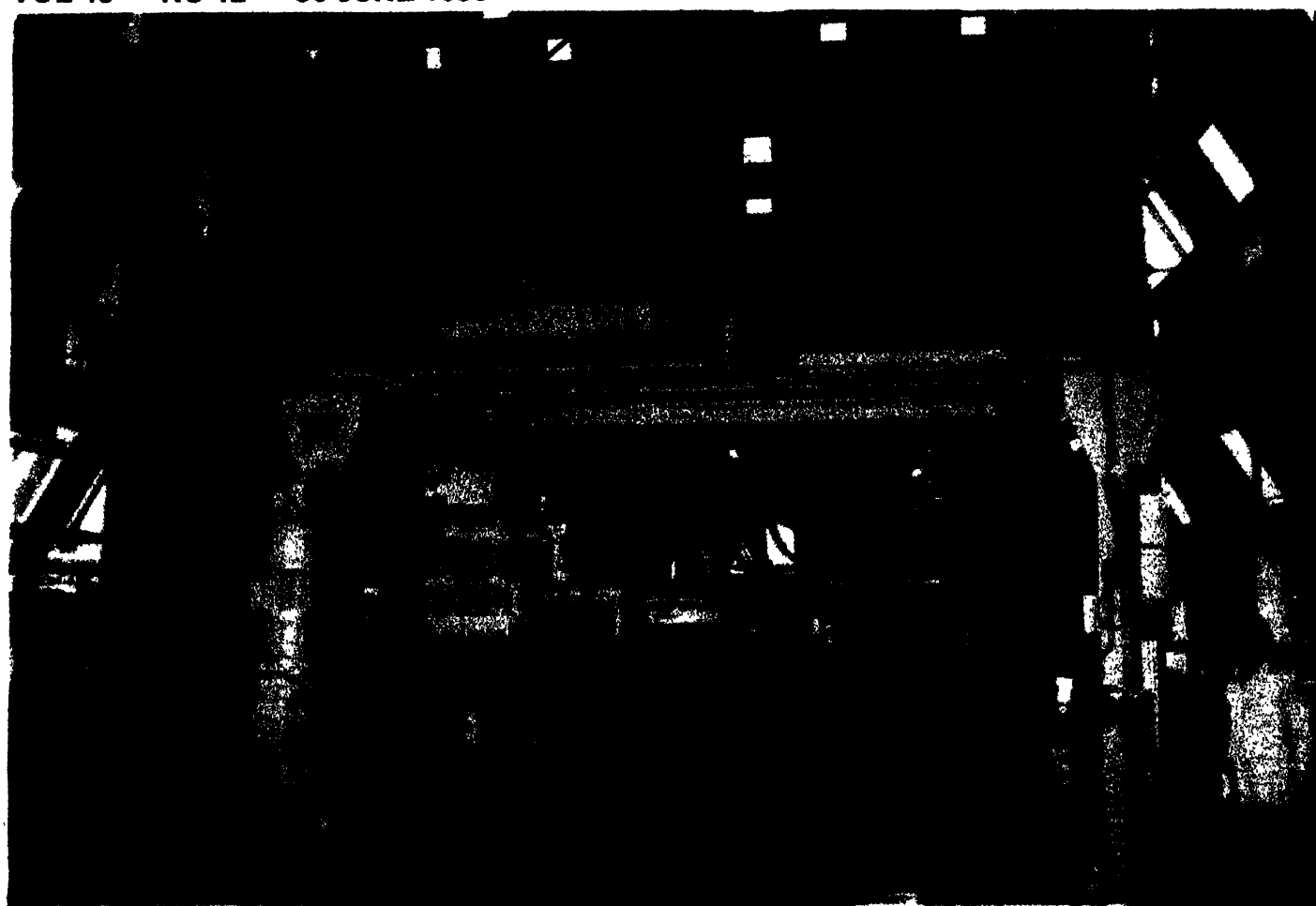
BN 461257

CSIR

NEWS



VOL 45 NO 12 30 JUNE 1995



IN THIS ISSUE

Central Fuel Research Institute, Dhanbad	
R&D Highlights: 1993-94	178
Dephosphorization of High Carbon Ferro-manganese	182
New Technique for Preservation of Plants	182
Computerized Database of Legumes of South Asia	183

A view of the Pulver-Ash Project L&P plant at Durgam, West Bengal, that produces fly ash bricks based on technology developed by Central Fuel Research Institute, Dhanbad. The plant produces one lakh bricks per day

Breakthrough in Chrome Management

189

Central Fuel Research Institute, Dhanbad

R & D Highlights: 1993-94

FINANCIALLY, the Central Fuel Research Institute, Dhanbad, has done quite well. Its extra budgetary resources increased from 14% of the total resource availability in 1992-93 to 28% in 1993-94. However, increase in the actual outlay during the two years was 40%. A new division 'Business Development Group' has been created essentially to take care of client-oriented project formulation in addition to the existing activities of Project Monitoring & Evaluation and Technology Utilization & Marketing.

A significant discovery made during the year relates to a large



Inert gas generator developed by Central Fuel Research Institute, Dhanbad

deposit of low volatile coals, hitherto considered of medium coking variety, amounting to more than 20 billion tonnes and possessing superior coking qualities. These coals have been found to have a balanced vitrinite composition that would render them after washing into as good a coke as obtained from imported coals. The technical superiority of the washed product has been conclusively established by washing 1000 tonnes of coal in the pilot plant of CFRI and using the product in blends to produce coke in the coke ovens of Bokaro Steel Plant. Efforts are underway to commercialize the product. Resource profiles of 32 coalfields have been studied. Notable finding is the resources of Parbatpur in Jharia coalfield that can give 12-16% ash product with 70% yields and Ralgarrh coalfield that can give 10% ash in 3 m seam for power generation. Some of the other significant R&D achievements of the institute are as follows:

Coal

Generator to combat minefire.

Two coal field inert gas generators, which utilize controlled fluid bed combustion process, have been installed and commissioned. Test runs were conducted with coal procured from Sendra Bansjora Colliery. The gas produced contained less than 0.1% CO and below 2% O₂. A 25 h demonstration was arranged for the representatives of collaborating organizations, including BCCL, DGMS, CMPDI and CMRS. Field trials are now planned.

National Environmental Standard for coal washeries. The first phase of the work on monitoring of ambient air and effluents has been completed in four selected coal washeries in Bihar and an interim report to this effect was prepared and forwarded to the Central Pollution Control Board, New Delhi.

Steel

Solvent refined coal. This project initiated in 1981 to augment the meagre coking coal reserves of the country can also relieve the dependence on imported coals. It has been successfully demonstrated that through the incorporation (10% maximum) of solvent refined coal prepared from weakly coking coals, it is possible to eliminate prime coking coals (imported as well as indigenous) in the steel plant coking blends, partly or even fully, for producing blast furnace grade coke. The suitability of Assam coals found to be most effective for the preparation of solvent refined coal has also been ascertained. 50-60% of the sulphur is removed during processing. As a sequel to the possible commercialization of the process, keeping in view the expected growth of steel industry in the next 10-15 years, scale up studies are being planned. A proposal to build a 20 kg (coal throughput) fully instrumented unit has been prepared. Funding from the Ministry of Steel is awaited.

Complementary to the project, studies have also been carried out

on the behaviour of iron catalysts in the hydroextraction of coal and its effects on the yield and qualities of the solvent refined coal product. Possibilities of solvent re-use in this process for better economy have also been explored. A 200 kg/h super decanter centrifuge has been acquired and installed to facilitate the demineralisation studies aimed at producing 0.5% ash content solvent refined coal.

Coking coal augmentation. A major project in this continuous programme is to ascertain the beneficiation and coking potentialities of coals from lower seams. Samples from Goluckdih Open Cast Project (GOCP) were studied. Investigations carried out have confirmed that these coals can replace both indigenous and imported prime coking coals in the steel plant blends to produce a very good quality blast furnace grade coke. Coking tests were also conducted with these coals in the non-recovery type Kumbraj coke oven developed by CFRI. The coke produced was excellent and unmatched in terms of its cold and post reaction strength. Commercial scale coking tests carried out with these coals in the coke ovens of the Bokaro Steel Ltd also confirmed that they can be used as a substitute for indigenous prime coking coals.

Power

Coal beneficiation and slurry combustion. This is a proposed Mission Project under the Clean Coal Technology Mission of CSIR in association with Regional Research Laboratory, Bhopal, Central Mechanical Engineering Research Institute, Calcutta, Central Glass and Ceramic Research Institute,

Calcutta, Regional Research Laboratory, Bhubaneswar, Central Power Research Institute, Bangalore, and Bharat Heavy Electricals Limited. The aim of the project is to use high ash coals in old and small thermal power plants to improve their overall efficiency and at the same time make them environment friendly.

Basic data have been generated on cleaning potentiality of various types of coals found in Jambad (Raniganj coalfield), GOCP Middlings (Jharia coalfield), Talcher (Talcher coalfield), Dakra (North Karanpura coalfield), Kusbunda (Korba coalfield) and Niljal (Wardha valley coalfield). Slurry was prepared with the boiler feed coal (-200 mesh) obtained from Talcher Thermal Power Station, with and without stabilizer.

Basic studies on Talcher coal were also performed. Mineral and organic matter contents of different size and specific gravity fractions of coal samples were determined. The fractions were also subjected to proximate analysis, density measurement, petrographic analysis and L.T. ash treatment. The organic and mineral contents and the L.T. ash of the above fractions were studied through IR and X-ray analysis.

Beneficiation of thermal coals. An action plan has been drawn for the beneficiation of thermal coals. For this purpose, discrete samples of large good coal and stone pieces were collected from the feed along with samples of rejects from rotary breaker at Talcher Thermal Power Station for their qualitative and quantitative assessment.

Petroleum & Natural Gas

Synthetic oil from coal. Indo-Russian Collaborative Project (Integrated Long Term Programme) for conversion of synthesis gas into diesel oil is being pursued as an on going project. Three iron catalysts were formulated, prepared, characterized and tested. Of the three catalysts tested, two were for middle distillates and diesel oil production, and the third was for wax production as an in-house project.

The catalysts tested in the Process Development Unit (PDU) showed increased yields of diesel oil to the tune of 48.2 wt % of the liquid hydrocarbons but due to the presence of polar compounds diesel index decreased subsequently. Scaling up to pilot scale PDU has desirable effect; yield of diesel oil increased by 40 wt % and there was considerable improvement in the diesel index (80 in case of PDU scale compared to 94 in Pilot PDU scale). The BIS specification of diesel index is 46. The third catalyst designed for wax production has shown remarkable yield of upto 85 wt % of liquid hydrocarbons as against the maximum of 71.7 wt % reported in literature.

Lignite gasification to replace furnace oil. A preliminary feasibility report for the replacement of furnace oil (in rotary kilns for calcination of bauxite) by fuel gas produced from gasification of lignite is being prepared. A survey of gasification processes available for the conversion of lignite into gaseous fuel was completed and six processes, viz., Dow, Lurgi, Shell, Koppers, HTW and U-Gas were initially identified as suitable for gasification of lignite. The processes adaptable for Kutch lignite gasification were further

CFRI Technologies Ready for Commercialization

Coal & Steel

- Low medium temperature carbonization of coal
- Inert gas by Fluid bed combustion
- Generation of hot air by Fluid bed combustion
- Improved design of Beehive oven for hard coke manufacture (Kumbraj)
- Beneficiation of fine coal by heavy medium cyclone-cum-oil agglomeration (HMOA) technique
- Cost effective process technology for beneficiation of inferior (LVM) coals
- Chemical demineralization of coal for production of low ash coal
- Oleo-flotation for upgrading and dewatering of coal slurry

Petroleum and Natural Gas

- Production of synthetic liquid fuels and high yield middle distillate fraction from synthesis gas

Chemicals

- Beta-naphthol from naphthalene
- Cresols and Resorcinol from Toluene and Benzene respectively
- Purification of crude Anthracene and oxidation of Anthracene to Anthraquinone

- Ammoxidation of 3 and 4 Picoline to 3 and 4-Cyanopyridines
- Synthesis of pyridine bases
- Silica and oxalic acid from paddy husk

Industrial & Domestic

- Industrial briquetted fuel from coke breeze char
- Domestic briquette fuel from low grade caking coal washery byproducts (middlings/sinks)
- Pellet coke from washery byproducts and low grade coking coal slack
- Paddy husk combustor-cum-heat exchanger for drying of paddy
- Building bricks from fly ash
- Soft coke for domestic use by moving bed devolatilization of coal in chain grate stoker

- Resistor coke as packing material for graphitisation
- Active carbon from coal, lignite, coconut shell and wood
- Coal-fired improved domestic oven
- Attachment for domestic oven for smokeless combustion
- Smokeless ignitor

For further details, write to:
The Director, Central Fuel Research Institute, Dhanbad □

short listed to three, viz., Lurgi fixed bed, Dow entrained bed and HTW fluidised bed, on the basis of their merits. These processes are further being evaluated for identification of the most appropriate technology for gasification of Kutch lignite.

Lignite fuel oil slurry. Fuel oil can be partially substituted by Lignite oil stabilized slurry for use in existing oil-fired furnace and boilers with minimum alteration and marginal investment. It would save considerable foreign exchange.

Pillared interlayer clays and ZSM-5 zeolites. The technology for the preparation of Pillared interlayer clays, and ZSM-5 zeolite catalysts has been developed. The prepared samples were sent to the R&D Centre of Indian Oil Corporation for testing. Some of the samples have shown promise.

Chemicals

Pyridine bases. The lower pyridine bases, namely, pyridine and 3-picoline, are important industrial chemicals used for the production of drugs, agrochemicals and rubber chemicals. Their demand is mostly met by imports. A process for the production of pyridine and 3-picoline through cyclohydrogenation reaction of aldehyde and ammonia has been developed at CFRI using high silica zeolite catalyst prepared in the laboratory. The total yield of pyridine bases achieved was 57.64% by weight which comprised 53% pyridine and 3% picoline. The process has been licensed to M/s Shubhra Chemicals Pvt. Ltd, Delhi, for commercialization.

Industrial & Domestic Fuels

- **Processed fuels.** For producing smokeless domestic fuel, briquetting tests to assess the coal supplied by M/s D&G Coal Briquette Manufacturing Company, Umrangso, Assam, were performed at the Briquetting Laboratory of the institute. Briquetting-cum-carbonization tests were also performed with Low ash coke breeze supplied by M/s Wellman & Incandescent (India) Ltd., Calcutta, for ascertaining the potential of the breeze in an electro-furnace.
- Tests results revealed that the briquettes were of excellent quality and can be safely used in an electro-furnace for making low phosphorus steel.

Tests on the possibilities of briquetting waste materials from sugarcane industries were undertaken at the instance of M/s Zucker Gasification and Co-generation Pvt. Ltd., and the report of the tests was submitted.

Improved 'chulhas'. Improved chulhas, *Angarbandhu* and *Angarmitra*, of power ratings 1.0 kw and 1.4 kw (thermal efficiency 40%) and pollution level lower than conventional chulhas were designed, fabricated and tested at CFRI. They have been handed over to Mineral Area Development Authority (MADA) for popularization. The chulhas have been distributed to about one hundred expected users in eight blocks of Dhanbad district through MADA for feedback on their design and performance.

Efforts are being made to bring down the cost of the chulha and a portable pottery model of it is being developed. For fuel, coal and biomass were tried, with the provi-

sion for burning volatile matter to make it more economical. Plans are afoot to develop community coke chulhas.

Carbon molecular sieve for gas separation. Carbon Molecular Sieve (CMS) largely used in Pressure Swing Absorption is being used on an industrial scale for the separation of gases. Exploratory studies have been performed to assess the suitability of indigenous lignites for the preparation of CMS by proper thermal treatment, carbon impregnation, thermally induced crystal alignment, and controlled air activation. It has been observed that controlled activation with air, steam and steam-air mixture can improve the quality of the product further. A PSA testing unit has been procured recently to test the efficiency of a laboratory-made CMS.

Bricks from fluid bed ash. Four CFRI process-based plants manufacture building bricks from fly ash. Studies are being carried out to standardize process conditions. Ash from Fluid bed combustors of TISCO, Jamadoba, and ATIC industries, Gujarat, was studied in six batch compositions having different proportions of fly : bottom ash. Each of these six batches was subjected to different sets of binders and temperatures. Based on the two batch and binder compositions, standard size bricks (223 × 110 × 64 mm) were prepared and tested.

Basic Research

Desulphurisation of high sulphur coals. As a prelude to standardising the process of radiolytic desulphurisation of high sulphur coals (S=3 to 4%), chemical desulphurisation of Makum and Chalong coals was tried through oxidation with KMnO_4 + H_2SO_4 at room temperature. It re-

sulted in removal of upto 30% of sulphur present in the coals. The mid-oxidation treatment of these high sulphur coals with varying concentrations of H_2O_2 and acids (H_2SO_4 and H_3PO_4) followed by refluxing with water could remove sulphur to a similar extent (20-30%). However, increasing concentration of H_2O_2 beyond 30% V/V was ineffective in further removal of sulphur. Extended studies on chemical-cum-radiolytic desulphurisation of other high sulphur coals, as a function of various parameters, are in progress.

Effect of gamma-irradiation on coal and lignite. The Gamma-irradiation of Samla coal samples in different media (air, water and CCl_4) at 100 Mrad resulted in an increase of their solubility to 245%. FT-IR studies of the irradiated coals have indicated pronounced changes in their spectra, giving a deeper insight into the complex structure of the coals.

Non-caking coals. Temperature programmed reduction studies conducted on non-caking coals of Indian and Polish origins have indicated the presence of five types of organic sulphur, viz., disulphide, thiol, thioether, thiophene and thioketone. It has been observed that pyrolysis upto 600°C reduces disulphide and thiol groups to negligible amounts and thioketones have been converted into condensed thiophene groups.

Structural studies of coal. CFRI postulated coal-models have been further modified taking into consideration the latest findings on different ranks of coal. Rankwise distribution of different structures in coal is also being attempted. Oxidative degradation of coal through action of potassium permanganate has thrown some light on its complex structure. □

R & D Flashes

Dephosphorization of High Carbon Ferro-manganese

EXPERIMENTAL studies at the National Metallurgical Laboratory, Jamshedpur, have shown that it is possible to remove phosphorus selectively from ferro-manganese without loss of manganese, using a barium oxide-rich flux. Using this flux, more than 60% phosphorus

could be consistently removed. As a result, there is significant value addition to the product.

Presently, ferro-manganese produced in India usually contains more than 0.4% phosphorus. Despite years of research and developmental efforts, there is no established method for lowering the phosphorus content to the desired levels ($< 0.2\%$). At present, most of the low phosphorus ferro-manganese used for making high quality steel is imported.

The main disadvantage in the removal of phosphorus by the conventional oxidizing technique is the significant loss of manganese. The present process overcomes this drawback, and would be very useful to the ferro-alloy industry in preferential removal of phosphorus impurity from a high carbon liquid ferro-manganese at low level of silicon ($< 0.2\%$).

The scientists associated with the development of this process are Shri P.N. Chaudhary and Dr R.P. Goel. □

New Technique for Preservation of Plants

PLANT specimens in whole or parts are often preserved in formalin in a museum. Generally 4-5 % solution of liquid commercial formaldehyde is used for this purpose. However, the preservative in due course collects impu-

rities and turns yellowish and loses clarity, necessitating the replacement of formalin solution frequently.

To overcome this problem, the Research & Specimen Cell of the Publications & Information Directorate (PID), New Delhi, has developed a new method for making a

preservative in which a combination of repeatedly purified formalin by filtration, glacial acetic acid and saturated and purified cupric acetate solution is used. The solution thus obtained is very clear. More important, the solution does not turn yellow and remains clear for a longer time. □



Material preserved using formalin (left) and new preservative (right).

Seminars, Symposia & Workshops

Design and Establishment of a Computerized Database of Legumes of South Asia

UNDER an ongoing project 'Design and Establishment of a Computerized Database of Legumes of South Asia', which is sponsored by the Council of Scientific & Industrial Research (CSIR), Commonwealth Science Council (CSC) and UNESCO as part of the world wide project 'International Legume Database Information Service' (ILDIS), UK, the Second International Seminar cum workshop on the Design and Establishment of a Computerized Database of Legumes of South Asia was organized from 26 April to 5 May 1995. The workshop was organized in two parts: the first part was organized at the ILDIS-RICOSA, National Botanical Research Institute (NBRI), Lucknow, from 26 to 29 April 1995 and the second part was organized at the Central Department of Botany, Tribhuvan University (TU), Kathmandu, Nepal, from 1 to 3 May 1995. In India, the workshop was sponsored by CSIR/NBRI, UNESCO, Botany 2000 Asia, British Council, DBT, DST and INSA, and in Nepal by the Royal Nepal Academy of Science & Technology (RONAST), TU, WWF, Nepal, and ICIMOD. The workshop was attended by delegates from South Asian countries, viz., India, Pakistan, Nepal, Bangladesh and UK.

Dr. P.V. Sane, Director, NBRI, and Chairman, Organizing Committee, welcomed the chief guest and participants of SAARC countries. He informed that ILDIS-RICOSA activities have gone well ahead as per



Dr. P.V. Sane, Director, National Botanical Research Institute, Lucknow, giving the inaugural address. Sitting on the dais (from left) are: Dr. Sundarshan Kumar, Dr. R.M. Polhill and Dr. K.K. Shrestha

plan of work agreed upon in the first international workshop which was held at NBRI during 7-13 March 1994. NBRI has gathered information on the current plant names and distribution of all legumes of India, Pakistan, Nepal, Bangladesh, Bhutan and Sri Lanka. The data on Maldives and Myanmar would be added shortly, he said. Emphasizing the importance of second international seminar cum workshop, he said that it would help discuss the baseline inventory of South Asia legumes and sort out the problems encountered by the country representatives; impart training on amplification of the data on life form, conservation status, vernacular names and economic uses, etc.; and review the overall research on legumes in the region. He also pointed out the importance of close collaboration of scientists/organizations of neighbouring countries and Botanical Survey of India in the programme. He also mentioned the constraints in procuring information from Myanmar and Maldives and suggested that an intensive survey of Maldives should be made. This would

enable us not only to collect information on legumes but also on the flora of the other families, he remarked.

Dr. R.M. Polhill, ILDIS Coordinator, Royal Botanic Gardens, Kew, UK, was the Chief Guest on the occasion. In his Inaugural address, he gave a review of the activities of ILDIS programmes in South Asia. ILDIS, which is a collaborative programme, was actually pioneered by the University of Southampton and the Royal Botanic Gardens, Kew, UK, and the Missouri Botanic Garden, St. Louis, Missouri, USA. Elaborating the objectives of ILDIS, Dr. Polhill said that Phase I of this programme was responsible for the establishment of taxonomic database giving basic data and agreed taxonomic reference system for all legume species worldwide, while Phase II was linked with applied botanical data and biotechnological datasets. Many Regional Inquiry Centres (RICs) throughout the world are pooling information on a cooperative basis in ILDIS which was supported by many national and international agencies, Dr. Polhill said.

Dr. Polhill informed that the checklist on the legumes of West Africa, Indonesia and Northern Eurasia has already been prepared while work is continuing on the checklist of Malaysia, Australia and Indonesia. He thanked Dr. Sane for making available all the facilities for this programme which would result in the preparation of a checklist for legumes of South Asia. Dr. K.K. Shrestha, Central Department of Botany, Tribhuvan University, Kathmandu, emphasized the need of strengthening National Botanical Information Centres in Nepal under the programme and requested ILDIS-RICOSA and ILDIS Directorate to provide support for it. Dr. Sudarshan Kumar, Convener, thanked the various agencies for providing support and the scientists/organizations for providing data.

The workshop comprised seven technical sessions which included presentation of an overview of the worldwide ILDIS project and plan and progress of the work done since the first workshop held in March 1994 : review on geography; review of score sheets printed from NBRI database; detailed discussion on data collection of score sheets of Bhutan and Maldives; detailed discussion on an other aspect of Phase I. The participants were given training on the methods of data recording and for collecting additional data of various parameters; methods of data extension, exchange, and formulation of a project on establishment of computerised inventory of Maldives were discussed.

Part II was organized at the Central Department of Botany, Tribhuvan University, where presentations on review of legume research and field training were made. Shri Mod Nath Prasit, Minister of Education, Culture & Social Welfare, was also present on the occasion. In his inaugural address, Shri Prasit said that he was

happy to learn that Central Department of Botany, Tribhuvan University, Kathmandu, has initiated a project to promote studies on computerizing legumes of Nepal. He also appreciated the active support and collaboration of ILDIS-RICOSA in the organization of the international workshop. The Government of Nepal would provide active support in future, he assured. In his keynote remarks, Dr. R.M. Polhill said that the work at NBRI has gone very well and ILDIS-RICOSA is set up in a way that will meet all the needs of the current programme and provide a base for extending many future research programmes at NBRI. He also praised the facilities provided at the library of ILDIS-RICOSA at NBRI. He emphasized that NBRI should extend the database with more details on legumes under Phase II, especially their economic importance to man, and an extension to the basic work on other families, including the concepts of IOPI. Emphasizing the new concept of legume line, he said that it would greatly help in making data available through computer network BIDS to researchers, pharmaceuticals, industries, etc., and ILDIS-RICOSA at NBRI would provide similar data from China, Europe, Africa, North and South America and erstwhile Soviet Union. He also desired active collaboration of the neighbouring countries in this project.

On the first two days, 24 scientific research papers on taxonomy (Session I), cytology & floral biology (Session II), nitrogen fixation (Session III), economic botany (Session IV) and databases (Session V) were presented and discussed. Also, a detailed demonstration of database organization was done by Dr. Kumar using computer and LCD equipment brought from NBRI.

On third day, the participants were taken on a field trip to Phul-

chowki hills, which provided them opportunity to study and collect some plants in a protected area and share views on the taxonomy of certain species in field. The details of the species are being worked out. The participants were also taken to Botanical Garden and National Herbarium to have a glimpse of plant specimens of Nepal.

The workshop led to the finalization of geographical scheme for South Asia and all participants agreed to organize geography data at three levels: Country level, State Administrative division or Atoll (only in case of Maldives) level, and District or Island (only in case of Maldives) level. The following recommendations were made: (1) All relevant ministries of the participating countries should be requested to provide sufficient support for taxonomic research and collections of plant materials for undertaking the recommended programmes; (2) The International Biodiversity Programme of the Commonwealth Scientific Secretariat (CSC) should be requested to provide more institutional support; (3) National Botanical Database Centres of the Regional Network should be strengthened to ensure that all have appropriate access to data processing and communication facilities and have nominated personnel to participate in the programmes; (4) ILDIS Phase I Checklist should be taxonomically coordinated, the remaining fields incorporated as far as practicable to the agreed standards and made available to collaborating institutes as hardcopy and electronically in ALICE format. Country lists to be completed as far as possible by January 1996; (5) A network should be established for the systematic collection of chromosome numbers and to encourage further research aimed at reliable records supported by voucher specimens; (6) A regional

checklist of all vascular plants of South Asia should be planned based on the principles already followed for the ILDIS and IOPI projects and should be discussed at the next workshop; (7) Advice should be sought from a small Planning Group to initiate an ILDIS Phase II South Asia project on legumes of economic importance to man, with proposals brought to the next meeting; (8) The participants agreed in raising funds for the effective participation of nominated collaborators from Bhutan, Maldives and Myanmar; (9) Botanical exploration of Maldives should be extended by collective efforts of botanists of India, Sri Lanka and Maldives; and (11) The workshop discussed and recognized the need for the establishment of local centres in Myanmar. □

Drug Development

A conference on 'Emerging Areas in Science & Technology' (EAST) was organized recently at the Regional Research Laboratory, Jorhat, on the theme 'Drug Development based on Natural Products'. About 30 scientists from various research institutes and universities of the country presented papers in the area of drug development from medicinal plants. Close interaction amongst the participating scientists was followed by lively brain-storming sessions.

Welcoming the delegates on the inauguration day of the conference, Dr. Anil C. Ghosh, Director, RRL, Jorhat, explained the genesis and current importance of the conference organized for the first time in India and hoped that scientists coming from other parts of the country would make important intellectual contributions to generate lead ideas for the development of new drugs from plant resources abundant in northeast India.



Dr. Anil C. Ghosh, Director, RRL-Jorhat, delivering the welcome address. On the dais are (from right): Prof. B.N. Dhawan, Prof. Sukhdev, Prof. U.R. Ghatak, Dr. A.R. Bhaduri and Dr. J. Das

Inaugurating the seminar, former Director of Multichem Research Centre, Vadodara, Prof. Sukhdev said that learning and copying from nature is useful to scientists in developing new drugs and new scientific theories. Referring to certain plants grown in northeast India, he pointed out their resourcefulness in industrially important chemical compounds. He requested the scientists to go for a wide range of biological testings for every new compound isolated from plant sources.

Delivering the keynote address on 'Traditional medicines as source of new drug discovery' the former Director of Central Drug Research Institute, Lucknow, Prof. B.N. Dhawan focussed on the strategy of drug development from plant sources and pointed out that it was useful to take leads from tribal medicines but considering the post-GATT scenario it would be useful to search for new types of compounds only. Citing examples Prof. Dhawan also pointed out that in certain cases it was necessary to work on about 4000 plants to obtain four or five new drugs. He em-

phasized the importance of preservation of medicinal plants as well as ecology.

Prof. U.R. Ghatak, former Director of Indian Association for Cultivation of Science, Calcutta, emphasized the importance of creating up-to-date research facilities and of continuous education of scientists for development of new drugs.

Dr. G. Thyagarajan, former Director of Central Leather Research Institute, Madras, said that the future society would be knowledge- and innovation-based. He urged scientists to use new knowledge of modern biotechnology in developing new drugs. Dr. J. Das, a renowned biochemist from Indian Institute of Chemical Biology, Calcutta, and Dr. A.R. Bhaduri, a well known scientist from Central Drug Research Institute, Lucknow, made incisive observations on the strategies to develop drugs from plant resources and gave stimulating ideas. The inaugural function was followed by discussions which led to important recommendations. □

CSIR Libraries Meet

THE Second Meet of the Heads of CSIR Libraries was held at the National Institute of Oceanography (NIO), Goa, during 1 - 3 February 1995. More than 40 delegates from 34 laboratories participated in the meet.

The meet was inaugurated by Prof. Karl Banse, Emeritus Professor, University of Washington, Washington D.C., USA. In his address, he advocated the need for making modern library and information systems user friendly. Prof. B.L.K. Deekshatulu, Director, National Remote Sensing Agency, Hyderabad, who presided over the function, suggested the need for using alternative media such as the optical disk for preserving satellite data for archival purposes. Dr. E. Desa, Director, NIO, while welcoming the participants, highlighted the importance of adopting information technology for library and information services and stressed the need for a collective approach as a means to cater to the information needs of the users more effectively. Prof. T. Vishwanathan, Director, INSDOC, appraised the progress made since

the first meet at NAL, Bangalore, in 1993. Dr. Naresh Kurhar (IMTech, Chandigarh) presented a gist of the sub-committee report.

The technical sessions chaired by Prof. T. Vishwanathan included discussion on CSIR Information Consortium, Resource Sharing, Library Management and Manpower Issues. There was a general agreement to opt for publishing databases in CD format and for networking of all Library Information Centres (LICs) into a single national facility. The need for an overseeing body such as Technical Advisory Board (TAB) for providing a collective approach to the management of library and information resources of all CSIR libraries was also stressed. A sub-committee to prepare a manual on library management for CSIR libraries to bring in uniformity in the procedures was proposed. □

National Environmental Science Academy

THE National Environmental Science Academy (NESA) or-

ganized its Tenth Annual Congress jointly with the National Institute of Oceanography (NIO), Goa, during 8-10 March 1995 at NIO. The congress was inaugurated by Shri V. Gopala Ramanujam, Governor of Goa, while Prof. M.G.K. Menon, the eminent scientist of India, gave the keynote address. Dr. E. Desa, Director, NIO, presided over the function. Prof. V.P. Sharma, President of the Tenth Congress, gave the introductory remarks and Dr. K.C. Bose, President of NESA, Executive Committee, spoke about NESA activities.

Delivering the keynote address, Prof. Menon felt that the Ministry of Environment (MoE) should be more vigilant on the country's environment and should present a detailed report on the environment in the Parliament, in a similar way the Finance Ministry presents the Annual Budget. He also called for community action to tackle environmental issues at the local, regional and global levels. He pointed out that all the governments worldwide will have to face the problem of sustainable development of earth's resources arising out of not just man's needs but growing aspirations of the poor who want to attain what the rich have. "We need to think of the future", he said, and added that equity should be maintained not just 'within generations' but 'between generations'.

The scientific sessions covered plenary and guest lectures, oral and poster presentations and symposia in Hindi, Konkani and Marathi on the theme 'Man and Environment'. The topics of the presentations were oceanography, biodiversity, agriculture, health, industry, ecology and conservation.

The congress was attended by about 200 delegates from all over the country. A special exhibition on 'The Glimpses of Goan Environment' was organized by the Sci-



Dr. Karl Banse delivering the inaugural address. Seated on the dais (from left) are: Dr. E. Desa, Prof. T. Viswanathan, Prof. B.L.K. Deekshitalu, Dr. Naresh Kumar and Shri M.P. Tapaswi



Shri H.E.V. Gopala Ramanujam delivering the inaugural address at the X Annual Congress of the National Environmental Science Academy. Seated on the dais (from left) are: Dr. K.C. Bose and Dr. E. Desa

MINERAL industry has made major contributions to the economic development of the country since Independence. However, the rapid growth of mineral industry has witnessed considerable impact on energy and environment of the regions rich in minerals. In view of the fast growth in mineral industry envisaged in the coming years, such an impact on energy and environment is likely to intensify. It is therefore necessary to take a fresh look at energy and environmental problems in mineral industries, including conservation and resource developments for the right type of raw materials.

The Indian Institute of Mineral Engineers, Bhubaneswar chapter, and Regional Research Laboratory,

ence, Technology and Environment Department of Goa. Awards were presented for the three best

poster and oral presentations and for best papers in Hindi, Konkani and Marathi. □

DG visits NGRI Field Camps

PROF. S.K. Joshi, Director General, CSIR, accompanied by Dr. Harsh K. Gupta, Director, National Geophysical Research Institute (NGRI), Hyderabad, visited in March 1995 the NGRI's Integrated Geophysical Survey field camps located in and around Rajkot, Saurashtra, to get a first-hand knowledge of the geophysical studies, including field operations, logistics, technical problems and operational hazards, etc.

One of the most challenging problems in oil exploration in India has been the detection and mapping of sediments suspected to be hidden underneath the vast volcanic cover in western India. NGRI has taken up the responsibility of handling this complex problem under a sponsored survey programme funded by the Oil

& Natural Gas Corporation and Oil Industry Development Board, amounting to Rs 69 million. It has chosen an integrated approach involving specialized geophysical techniques, namely, seismic refraction/wide angle reflection, magnetotellurics, gravity and deep resistivity techniques. Integration of the results of these studies should produce a realistic and detailed subsurface structural model upto several kilometres in depth bringing out the thickness and configuration of the top volcanic layer and also the hydrocarbon targets, namely, the Mesozoic sedimentary formations overlying the crustal basement.

Under this two year project it is envisaged that by April 1996 a total of 800 line kilometres of seismic refraction (along four profiles), 600 MT soundings over a 5 km grid pattern, 3000 gravity

stations and 50 deep resistivity soundings would be collected covering a major part of the western half of the Saurashtra peninsula. These data, along with the other existing data, would be inverted using latest techniques to map the bottom of lava flows and the basement. The magnitude of the work is believed to be one of the biggest geophysical experiments undertaken in the country. The field operations were initiated during December 1994. During 1994-95, a total of 400 line kilometres of seismic refraction/wide angle reflection data, about 170 magnetotelluric sounding data, 3000 gravity stations data, and 30 deep resistivity sounding data were completed covering important segments of the western part of Saurashtra peninsula. □

Bhubaneswar, jointly organized in the recent past a national seminar on 'Energy, Environment and Resource Development for Mineral Industry' at Bhubaneswar to draw attention of all concerned about environment and conservation of mineral resources and energy in mineral industry.

The seminar called ENRED-95 was inaugurated by Dr. B.N. Singh, Managing Director, Rourkela Steel Plant. Prof. H.S. Ray, Director of the laboratory, presided over the inaugural session. Dr. S.K. Tamotia, Chairman-cum-Managing Director, NALCO, and Dr. K.S. Narasimhan, Director, CFRI, were the guests of honour. Shri M.I. Ansari, President, IIME Bhubaneswar chapter, welcomed the delegates. Dr. R. Bhima Rao, Convener, proposed a vote of thanks.

About 180 delegates representing major R&D organizations dealing with minerals attended the seminar. About 75 technical papers were presented in nine technical sessions covering environment, energy, characterization, beneficiation, extraction and waste utilization. Eight invited lectures by eminent personalities in the above mentioned fields were arranged in different technical sessions. A preprint volume was brought out with selected papers and was supplied to all the delegates. A souvenir containing abstracts of 110 technical papers and information concerning the seminar was released.

The concluding session was chaired by Prof. H.S. Ray, and the Chairmen of different technical sessions briefed on their respective sessions. Some of the important recommendations related to: combating the environmental problems without hampering the development of mineral industry; development of mineral industry

with proper care to reduce pollution due to mining and processing; and de-reservation of forest area for mineral industry. □

Training Programmes

Food Contaminants and Adulterants

THE Industrial Toxicology Research Centre (ITRC), Lucknow, organized two training programmes simultaneously on 'Food Contaminants and Adulterants' and 'Metals and Food Colours' in the recent past. These programmes were sponsored by the Indian Council of Medical Research (ICMR), New Delhi. The main objective of the training programmes was to widen the analytical manpower base and to upgrade the existing analytical expertise in the food labs, and their sensitization to this important area hitherto neglected in the country. The other inherent objective was to bring uniformity and harmonization in the analysis methodology for food contaminants being adopted throughout the country. During the inaugural function Dr. Mukul Das, Convener and Assistant Director, welcomed the delegates of the training programmes who had come from different parts of the country. In his Inaugural address Prof. V.D. Gupta, Emeritus Scientist, Ex-Vice Chancellor, Gorakhpur University, the Chief Guest, spoke on the recent developments in the instrumental techniques which could be used for analysis of food contaminants and adulterants. Dr. S.K. Khanna, Organizing Secretary and Senior Assistant Director, presented the genesis of the training programmes. Dr. P.K. Seth, Deputy Director, highlighted the work conducted at ITRC on the monitoring of food commodities. He empha-

sized that this work has resulted in mass awareness as well as in fixing of realistic levels of contaminants under Prevention of Food Adulteration Act of India. Dr. R.C. Murthy, Scientist, proposed a vote of thanks.

The trainees for these programmes were selected from various universities, medical colleges, including the All India Institute of Medical Sciences, industries and state food laboratories, and included research fellows, senior analytical officers, public analysts and faculty members. They were acquainted with the conventional and sophisticated analytical methods, including instrumental techniques, through demonstrations. General lectures on the scope of food surveillance and contaminant hazards were delivered by the guest faculty. These lectures covered areas such as good laboratory practices, sophisticated instrumental techniques, statistical evaluation and designing, and computer software usage together with impact of environmental pollution and intervention measures in the form of epidemiological studies. □

Frits and Glazes for Wall Tiles

THE Central Glass and Ceramic Research Institute, Naroda Centre, Ahmedabad, recently conducted a Training-cum-Demonstration Programme for making frits and glazes for wall tiles for prospective small and large scale ceramic units located in Morvi, Thangadh, Surendranagar, Ahmedabad and Rajkot in Gujarat. The formulations for opaque and transparent frits and matching glazes for wall tiles were standardized to meet the requirements of users. Special emphasis was laid on manufacturing low-cost

Breakthrough in Chrome Management

THE disposal of chrome sludge continues to pose an environmental challenge to Indian tanners. A tripartite collaboration among the Central Leather Research Institute, Madras, Regional Research Laboratory, Trivandrum, and the TNO Institute of Applied Physics in Eindhoven, The Netherlands, has led to a major breakthrough in chrome sludge utilization for coloured wire cut brick manufacture. The success was achieved in the existing mechanized brick unit of M/s Raja Tiles, Trichur, Kerala. A viable technology for the manufacture of coloured wire cut bricks from clay and chrome sludge mixture was developed and tested at the rate of 5000 bricks per batch scale. The bricks were burnt using a novel technique to prevent the formation of chromium. These have successfully undergone chrome leachability studies.

Both the existing and new mechanized brick units in various states would be encouraged to adopt this cost effective technology through CLRI-TNO dissemination and Leather Technology Mission programmes.

In-process enhancement of chrome uptake is one of the best alternatives for a long range chrome management. Two commercially attractive closed loop processes based on (a) Ethanolamine pretreatment and (b) Alutan-BCS combination have been developed by the CLRI-TNO-BLC (UK) joint investigation and field tested at M/s Jal Bharat Tannery, Ambur, and M/s Mow Chong and M/s Titan Leather Tanneries at Calcutta. This technology is expected to emerge as the logical choice for chrome management in the years to come. □

frits utilizing the indigenously available raw materials and chemicals.

The one week programme comprised theoretical lectures and practical demonstrations covering the following aspects: recent advancements in the production of ceramic tiles; basic raw materials and their characteristics; preparation of tile bodies and making of tiles; wall tile frits and glazes; kiln furniture for wall tile production; firing of ceramic tiles and ceramic kilns; decoration of wall tiles; properties of glazed wall tiles; testing and control; and defects in wall tiles production and their remedies.

Nine participants from different ceramic units participated in the training-cum-demonstration programme. This programme was the first of its kind organized by the Centre since its inception in 1977.

At the valedictory session of the programme Dr. K.N. Maiti, Scientist-In-Charge, welcomed the Chief Guest, Shri R.J. Shah, Chief Industrial Adviser, Commissionerate of Industries, Government of Gujarat, distinguished guests from the industry and State Government agencies, participants and delegates. The Chief Guest distributed certificates to the participants of the training programme. □

Entrepreneurship Development

AN 'Entrepreneurship Development Programme' for rural areas was organized by the CSIR Polytechnology Transfer Centre, Patna, at Katihar, Bihar, from 27 March to 4 May 1995. The programme was sponsored by Small Industries Development Bank of India. Under this programme, about 50 entrepreneurs interested in setting up their new enterprise based on CSIR technologies were selected and trained through lectures, demonstrations, industrial visits and market surveys. The topics discussed included entrepreneurial qualities, financial management, financial analysis, marketing strategies, formalities in enterprise launching, problem solving, sales and salesmanship and other related aspects required for the successful launching of an enterprise. The main attraction of the programme was discussion of various CSIR technologies, particularly the food and agro-based technologies appropriate for Katihar district. More than 500 technologies were discussed in details and some were demonstrated. These related to preparation of jam, jelly, species, beverages, squashes, tomato sauce, tomato puri, instant pickles, papad, buri, leaf cup/plate, dal, etc. A compendium of technologies compiled by Dr. M.S. Alam, Scientist, and Dr. Naseer Ahmad, Project Officer, PTC, Patna, was also distributed among the entrepreneurs, faculty members and press/media persons. These low-cost technologies were very much liked by the entrepreneurs and most of the entrepreneurs decided to set up their enterprise on food and agro-based technologies developed by CSIR laboratories.

All the entrepreneurs were registered for their new enterprise



The Chief Guest Shri Ujjwal Kumar, Deputy Chief Commissioner, Income Tax, Patna, delivering the keynote address at the Entrepreneurship Development Programme held at Katihar

through District Industries Centre, Katihar, and certificates of registration of their industries as well as training certificates were given to them by the District Judge of Katihar.

Dr. Naseer Ahmad, Project Officer, and Dr. M.S., Alam, Scientist, PTC, Patna, who organized this programme are now conducting follow-up studies so that the entrepreneurs could be helped in setting up their enterprises successfully. PTC-Patna also organized a short-term training programme on Food and Agro-based Technologies developed by CSIR-Labs at Shri Krishna Science Centre, Patna, and Hazipur from 29 April to 1 May 1995, which was specially meant for ladies. Dr. P.P. Gothwal, Scientist, CFTRI, Regional Centre, Lucknow, was invited to train the entrepreneurs. More than 200 lady entrepreneurs attended the programme. □

Entrepreneurship Development in Ceramics

AN Entrepreneurship Development Programme (EDP) in ceramics for science and technology persons sponsored by the Department of Science and Technology, New Delhi, and co-sponsored by the Industrial Development Bank of India, Bombay, Industrial Finance Corporation of India, New Delhi, and Industrial Credit and Investment Corporation of India, Bombay, was conducted at the Central Glass & Ceramic Research Institute's Naroda Centre, Ahmedabad. Fourteen engineering science graduates and diploma holders attended the programme held from 14 February to 28 March 1995. The programme was inaugurated by Shri R.J. Shah, Chief Industrial Adviser of Government of Gujarat. The scope and objectives of EDP, the basis of selection of projects, characteristics of an entrepreneur, achievement and motivation training, etc., were elaborated by the experts from Commissionerate of Industries,

Centre for Entrepreneurship Development, Ahmedabad, and Entrepreneurship Development Institute, Ahmedabad.

Opportunities in ceramics and assistance available were highlighted by the faculty members drawn from CGCRI's Naroda Centre, Commissionerate of Industries, Small Industries Service Institute, National Small Industries Corporation, Khadi & Village Industries Commission, Industrial Extension Bureau of Gujarat, Gujarat Industrial Development Corporation and Gujarat Industrial & Technical Consultancy Organisation as well as from the existing ceramic industry in Gujarat. Topics like financial management, including cost of projects, assessment of working capital, outline of financial accounting, breakeven analysis, etc., and market research and market survey were discussed by the experts from financial institutions and GITCO respectively.

Various elements of ceramics, namely, occurrences and selection of raw materials and their preparation, formulation and preparation of different types of ceramic bodies, plaster of paris and making of moulds, different forming techniques, drying of ceramic wares, ceramic glazes and colours, kiln furniture, ceramic kilns and firing operations, decoration of ceramic wares, etc., were discussed in details. Various schemes for the manufacture of traditional ceramic ware like wall and floor tiles, crockery and tableware, sanitaryware, low tension insulators and refractories were also discussed.

Financial assistance available from banks and financial institutions for setting up of new ceramic units in Gujarat were discussed by experts from State Bank of India, Small Industries Development Bank of India, Industrial Development Bank of India and Gujarat

Airfield Pavements

AIRFIELD Pavements has been brought out by the Central Road Research Institute, New Delhi, to provide the relevant guidance to the Indian airport engineers. It was released by the Air Vice Marshal H.M. Shahul, AVSM, VSM, Chairman, Airport Authority of India, on 3 April 1995 during the inauguration of the Second Asia Pacific workshop on 'Airfield Pavements' organized by the International Civil Aviation Organization at New Delhi.

The document deals with all aspects of airfield pavement design, construction and maintenance, viz., materials, specifications, design, drainage, construction, quality control, structural evaluation, functional evaluation, overlay design and maintenance. The chapter 'Materials & Specifications' deals with the engineering properties of soils, aggregates and binders, and the current and emerging specifications for various layers of the pavement. The chapter on 'Design' covers the various aspects of flexible and cement concrete pavements. It gives a summary of the Aircraft Classification Number - Pavement Classification Number (ACN-PCN) method of aircraft rating and pavement evaluation, includes a section on design for high traffic volumes, and indicates the future scenario. It gives the main characteristics and landing gear dimensions of a number of transport aircraft, includes design curves for flexible and rigid pavement, and lists out the ACNs of several aircraft types. Considering the importance of proper drainage for longevity of airfield pavements, a chapter is devoted to the subject.



Shri R.J. Shah, Chief Industrial Adviser, Government of Gujarat, delivering the inaugural address at the Entrepreneurship Development Programme in ceramics held at Naroda

State Financial Corporation. Rules and regulations pertaining to sales tax, income tax, labour laws and factory acts were discussed by experts invited from Sales Tax, Income Tax and Labour Commissioner's offices. Formalities connected with provisional registration with the District Industries Centre were discussed by its representative.

Apart from theoretical lectures in the elementary ceramic subjects, practical training and demonstrations on standard ceramic practices were also conducted coupled with visits to different ceramic units.

The participants expressed their satisfaction over the course content and stated that they got all the relevant information on setting up of new enterprises in the small scale sector. They also expressed their satisfaction over the full co-operation received from all the staff members of CGCRI, Naroda Centre. They felt that although they were unaware of ceramic subjects the topics were dealt with so well that they could understand the same without any difficulty which will help in quality improvement

and sales of ceramic products. They also suggested that the EDP to be conducted in future may also be extended to commerce graduates.

The Chief Guest at the valedictory function, Shri R.J. Shah, Chief Industrial Adviser, Government of Gujarat, gave away certificates to the participants during the valedictory function.

Shri V.D. Patel, Chairman, Gujarat Ceramic Industries Development Board; Shri M.P. Palriwala, Member, All India Pottery Manufacturers Association; Smt. Sarojben, President, Surendranagar Pottery Association; and Shri J.V. Bhatt, Senior Development Officer, Industrial Extension Bureau, Government of Gujarat, spoke about the impact of the programme on employment generation and rapid industrialization in the State. They also appreciated the activities of the centre and the efforts being made by it for the upliftment of ceramic industries in Gujarat. □

Announcement

Training Programme on Writing a Scientific Paper

THE Publications & Information Directorate, New Delhi, will organize the above training programme during 9-13 October 1995. Meant for junior level scientists in R & D organizations, university lecturers and research scholars, the programme will cover the following topics: Channels of S & T Communication; Characteristics of S & T Writing; Elements of a Scientific Paper; Planning & Organization of a Paper; Review articles; Technical Proposals; Popular Science Writing; Ethics of S & T Communication; Electronic Publishing, etc.

The fee for the programme is Rs 750 (payable through cheque /demand draft drawn in favour of Publications & Information Directorate, New Delhi 110012). The last date for receiving the nominations is 31 August 1995. The number of participants will be limited to 20. Further information regarding the programme can be had from: Dr. Gian Singh, Publications & Information Directorate, Dr K.S. Krishnan Road, New Delhi - 110012; Telephone: 5726014, 5786301/238. □

The chapter on 'Construction' includes a detailed section on cur-

rently available types of construction equipment, and guidelines for construction of pavements. Quality control being of prime importance in increasing the life of a pavement is covered in a separate chapter. 'Structural Evaluation' includes a detailed account of the different evaluation methods suitable for airfield pavements. It also includes information on additional characteristics of typical transport aircraft and the traffic factors for various aircraft on flexible and rigid pavements required for assessing pavement life which depends upon the landing gear configuration and the load on the landing gear. The chapter on 'Functional Evaluation' deals with



the quantification of runway surface characteristics, viz., unevenness/riding quality, skid resistance and texture, tips for incorporation of better surface features for new runway, and methods for improving the surface of old pavements. A major part of

airfield pavement construction activity in India involves upgrading the existing runways to higher PCNs so as to cater to the increasing requirements of air traffic. 'Strengthening and Overlays' - both flexible and rigid overlays - deals with the subject in detail. The maintenance and upkeep aspect of existing airfield pavement facilities so as to ensure optimum serviceability is dealt with in the last chapter. Each chapter ends with an executive summary listing out the essential requirements under the topic, and includes detailed figures and tables.

The document is a comprehensive and up-to-date treatment of all important aspects of airfield pavements at one place, and is particularly useful for the practising engineers concerned with the design, construction and maintenance of airfields; planning and design consultants; construction agencies, etc.

The document (Price Rs 500 + Postage Rs 25) can be had from: Director, Central Road Research Institute, Delhi-Mathura Road, New Delhi 110 020. □

Doctorate

A. Giridhar

SHRI A. Giridhar, Materials Science Division, National Aerospace Laboratories, Bangalore, has been provisionally awarded Ph.D. by the Mangalore University for the thesis titled 'Investigations on chalcogenide network glasses'. The research was conducted under the guidance of Dr. Sudha Mahadevan of the Materials Science Division. □

Printed and Published by Dr G.P. Phondke, Director, Publications & Information Directorate (PID), Dr K.S. Krishnan Marg, New Delhi - 110 012
Printed at PID Printing Unit

Editors : Dr B.C. Kashyap, Dilip M. Salvi and Madhu Sahni

Production : Kaushal Kishore

Annual Subscription : Rs. 60
Single Copy: Rs. 3.00

Phone: 5786301

Gram: PUBLIFORM

Telex: 031-77271

E-mail: pld@simetd.ernet.in.

Fax: 5787082

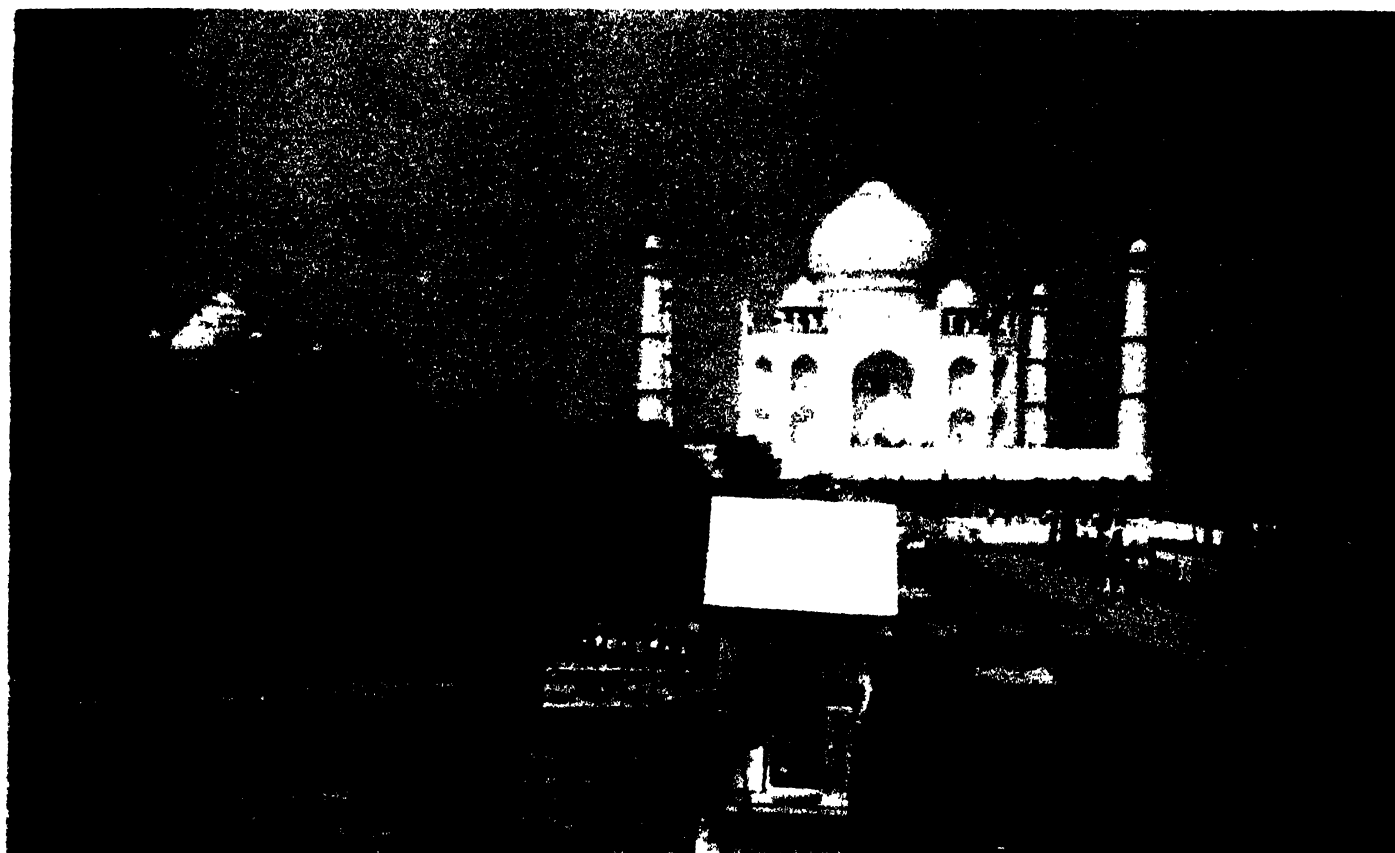
RN 4512/57

CSIR

JOURNAL



VOL 45 NO 13 15 JULY 1995



IN THIS ISSUE

Dr P.A. Mashelkar takes over as DG, CSIR	184
National Environmental Engineering Research Institute, Nagpur	
R & D Highlights: 1994	196
Congress on Corrosion Control	200
Conference on Powder Metallurgy	201

Air Quality Monitoring being carried out by National Environmental Engineering Research Institute, Nagpur, at Taj Mahal. A report on the R & D activities of the institute appears on page 196.

New Aircraft Design Centre at NAL

206

Dr R.A. Mashelkar takes over as Director General, CSIR

DR Raghunath Anant Mashelkar, a recipient of Padmashri in 1991 for his outstanding contributions to science, has taken over as Director General, Council of Scientific & Industrial Research (CSIR) and Secretary, Department of Scientific & Industrial Research (DSIR), with effect from 30 June 1995 (afternoon). At 52, he is the youngest Director General of CSIR.

Dr Mashelkar (born 1 January 1943) is an internationally acclaimed chemical engineer. He did his B.Chem. Engg. (1966) and Ph.D. (1969) from the University of Bombay, and then went to U.K. where he worked as a Leverhulme Research Fellow during Oct. 1969-Sept. 1970 and as a lecturer in chemical engineering during Sept. 1970-Nov. 1976 at the University of Salford. He joined the National Chemical Laboratory (NCL), Pune, as Assistant Director in November 1976 and rose to become the Director of this premier CSIR laboratory in June 1989, a position he held till he took over the present assignment.

Dr. Mashelkar has made original contributions to diverse areas of polymer science and technology. His major contributions relate to modelling of industrial polymerization reactors, molecular and convective diffusion phenomena in polymeric media, transport phe-

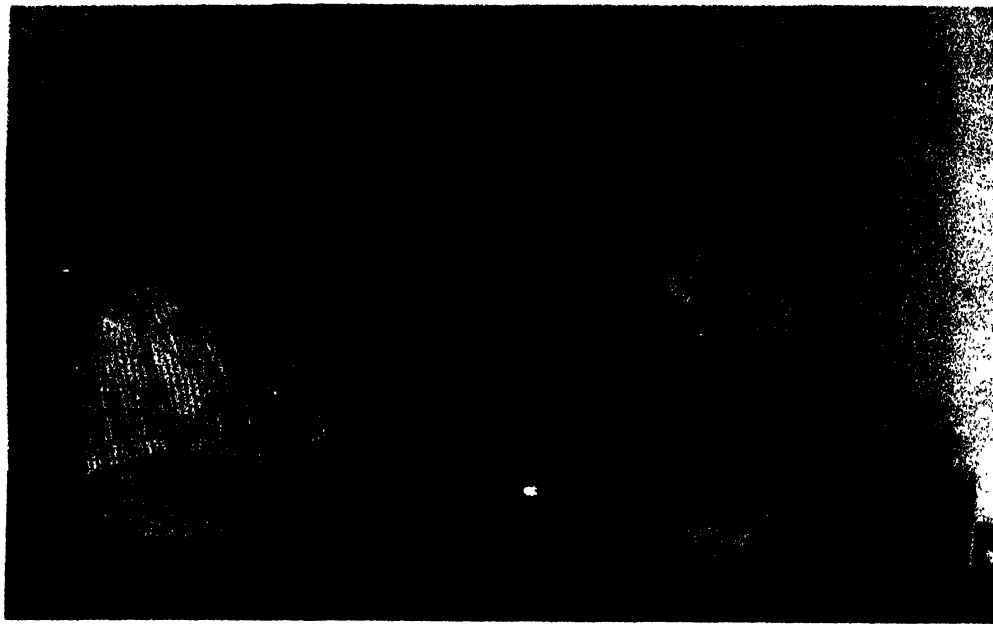
nomena in swelling, superswelling and shrinking polymers, and engineering analysis of non-Newtonian flows.

Dr Mashelkar is credited with promoting the culture of modelling and simulation in Indian chemical industry through diverse efforts, such as in melt spinning (fibre industry), PAN reactor (IPCL), naph-

In addition to his individual efforts, Dr Mashelkar is also credited with establishing the first Polymer Science & Engineering Group in India in the early eighties. Today, with 50 active scientists and world class facilities, this group has made significant contributions towards the development of engineering and speciality polymers and polymeric alloys/blends/com-

posites. An example of the speciality polymers developed is *Jal-shakti*, a super absorbing class of polymer, which was introduced commercially (Indian Organic Chemicals) for the first time in India based on the work of the group led by Dr Mashelkar. The polymer is used in certain selected fields of horti-

culture, agriculture, forestry, wasteland development, etc. It is being also used in alternative cold chain systems (BAIF, Pune), speciality baby diapers (India Diapers, Aurangabad), nuclear waste disposal (Indira Gandhi Atomic Research Centre, Kalpakkam) and dust control in open cast mining (many fields in Bihar and Madhya Pradesh). Other speciality polymers developed under his leadership include a highly shear stable drag reducer (US patent 5080121) produced by Lubrizol, a support for an immobilized enzyme produced by Hindustan Antibiotics Ltd, etc.



Dr R.A. Mashelkar taking over as the Director General, CSIR, from Prof. S.K. Joshi

tha reforming (IPCL), reactive granulation (HL) and accident investigations (Bhopal and MGCC accident). His work on simulation of polyester reactors has been exploited innovatively by Indian polyester fibre industry (Indian Organic Chemicals, Petrofils, DCL polyester, J.K. Synthetics) to augment the productivity, improve the product quality as well as for deciding on the technology options on a scientific basis. His models have been also used by many leading polyester manufacturers abroad, such as Eastman Kodak (USA), Toyoba (Japan) and Nylon Spinners (South Africa).

Besides carrying out core R&D, Dr Mashelkar has been instrumental in evolving and implementing progressive R&D and technology management concepts and ideas. As a result of his initiatives, the cash inflow of NCL from extra budgetary resources increased from Rs 30 million in 1989-90 to Rs 75 million in 1994-95, and the quality and number of scientific papers also improved significantly. Another major achievement of Dr Mashelkar pertains to globalization of the NCL clientele. Presently, NCL has on-going collaboration with some of the well-known companies in the world, viz., General Electric Company (USA), DuPont (USA), FMC (USA), CIBA (Switzerland), AKZO (Netherlands), Unilever (Europe) and many others. In fact, NCL today ranks amongst the finest chemical laboratories the world over.

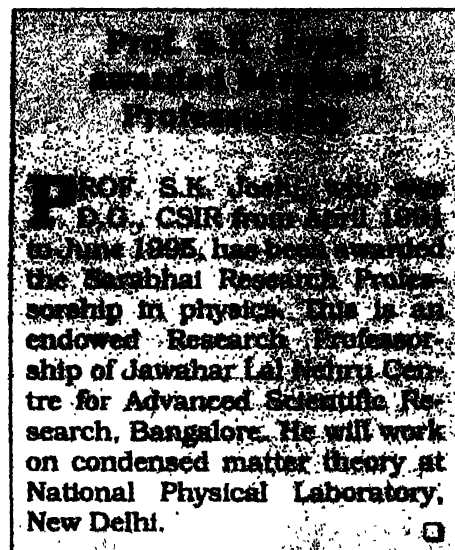
As Chairman of the Mashelkar Committee on Marketing of CSIR Knowledgebase, he has made recommendations to make CSIR more user responsive, market driven and globally competitive; the report of the committee has been adopted recently. He has also provided innovative ideas and concepts as a member of several government committees, e.g., Science Advisory Council to the Prime Minister, Science Advisory Committee on Petrochemicals, Science Engineering Research Council, Central Water and Pollution Control Board and Indo-German Consultative Group.

Dr Mashelkar has been an active consultant to Indian industry and leading companies in USA and Europe. He has been on the Board of Directors of Indian Petrochemical Corporation Ltd, Vadodara,

Hindustan Fluorocarbons Ltd, Hyderabad, Haldia Petrochemicals Corporation Ltd, Calcutta, Technology Development and Information Company of India Ltd., Bangalore, Maharashtra Petrochemicals Corporation Ltd, Bombay, and Technology Board, Industrial Credit and Investment Corporation of India. He has also been a consultant to World Bank for the restructuring of industrial R&D set-up in Indonesia, and Unilever, Europe, for restructuring its R&D set-up.

He was appointed by the Government as Assessor for the One-man Inquiry Commission investigating into the Bhopal Gas Tragedy (1985-86), and as Chairman of the Committee for investigating the Maharashtra Gas Cracker Complex accident (1990-91).

Dr Mashelkar is recipient of a large number of prestigious awards: Shanti Swarup Bhatnagar Prize (1982), Herdillia Award (1982), Santappa Silver Jubilee Award (1983), Chinnaul Memorial Prize (1983), UDCT Outstanding Alumni Medal (1984), K.G. Naik Gold Medal (1985), FICCI Award (1987), Viswakarma Medal (1988), Padmashri (1991), O.P. Bhasin Award (1991), Pandit Jawaharlal Nehru Award for Technology (1991), G.D. Birla Award for Scientific Research (1993), Honorary Doctorate of Science, University of Salford, UK (1993), UDCT Diamond (1994), Raj Kristo Dutt Memorial Award (Indian Science Congress Association) (1994-95) and NRDC Republic Day Award (1995). He has been associated, in various capacities, with more than a dozen scientific academies/bodies which include Indian National



Science Academy, Indian Institute of Chemical Engineers, Society for Polymer Science in India, International Committee on Rheology and the Third World Academy of Sciences. Also, he has been on the editorial boards of around 15 national/international journals.

Dr Mashelkar has delivered a large number of invited lectures in Indian/foreign universities/institutes/R&D organizations. The recent ones include: Danckwerts Memorial lecture (London) (1994), INSA-Jawaharlal Nehru Birth Centenary lecture (1995), Acharya P.C. Ray Memorial Lecture of ICMA (1995) and Lala Karam Chand Thapar Centenary Memorial lecture (1995).

Dr Mashelkar has to his credit over 180 research papers in international journals. Besides, he has edited 16 books on topics, such as *Heat Transfer Equipment Design*, *Recent Trends in Chemical Reaction Engineering* and *Readings in Solid State Chemistry*.

(Dr R.A. Mashelkar's interview: next fortnight)

National Environmental Engineering Research Institute, Nagpur R & D Highlights: 1994

THE goal of sustainable development warrants the pursuance of an effective R & D programme in the environmental science and technology to enable solutions to the existing and future environmental problems emanating from development imperatives, in the various socio-economic sectors. The National Environmental Engineering Research Institute (NEERI), Nagpur, while fulfilling its commitment towards National and Societal Missions and CSIR Thrust Area activities, has made significant contributions during 1994 in the areas of environmental monitoring, environmental biotechnology, toxic waste management, environmental systems design, modelling and optimization, environmental impacts & risk assessment, and environmental analysis.

The EBR (extra-budgetary resource) receipts of the institute continued to register a phenomenal increase: from Rs 55.68 million in 1991-92 to Rs 72.82 million in 1992-93 to Rs 102.17 million in 1993-94. The EBR receipts during 1993-94 comprised Rs 55.40 million from the sponsored projects and Rs 46.77 million from the developmental projects.

A brief account of the significant contributions of the institute during the past year is given below:

SOCIETAL MISSION AND CSIR THRUST AREA PROJECTS

The institute submitted eighteen inspection reports on air and water pollution control systems in the states of U.P., Bihar and West Bengal to the Supreme Court of India. It continued to participate in the

National Physical Laboratory Coordinated Inter-Laboratory Programme on preparation of Indian Reference Materials (IRMS), and contributed to the preparation of IRMS for mercury, selenium and milk powder.

INSTITUTE'S THRUST AREAS

Environmental Monitoring

The major R&D contributions made in the area of Environmental Monitoring include: Air quality monitoring in ten cities, audit of Global Environmental (Air) Monitoring Stations in South East Asian countries; development and use of nucleic acid probes for detection of *Entamoeba histolytica* and enteric viruses in drinking water; development of microprocessor-based low cost monostatic SODAR; use of neutron activation analysis technique for estimation of trace elements in environmental samples; development of biosensors for pesticide residues; development of National Protocol for evaluation of toxicity in industrial effluents; evaluation of slow sand filter plants in Andhra Pradesh; management of phenol contamination in Pecchi reservoir; and studies on pollution abatement in Damodar and Hooghly rivers.

Environmental Biotechnology

Application of natural and recombinant microorganisms for biosurfactant production; oil spill degradation and pollution control; recombinant DNA application to anaerobic fixed film systems for methane biosynthesis; de-emulsification of water-in-oil emulsions by *Bacillus subtilis*; recovery of hy-

drocarbons from oil sludges using bacterial de-emulsifier; development of non-causal model and microbial methods for clean up of oil spills; preemptive microbial desulphurization of coal, crude oil and flue gases; biotechnological conversion of lignocellulosic substrates to cellulase, liquid glucose and value-added chemicals; biotechnological production of biodegradable plastics from wastes; and multiplex PCR technique for environmental monitoring, and bioremediation technology, are some of the contributions in the area of environmental biotechnology.

Toxic Waste Management

R & D activities in this area related to: inventorization of hazardous waste generation in Maharashtra state; application of clayey soils as liners in secured landfills; management of oily waste in refineries; assessment of leaching potential of various waste streams in a refinery; rapid risk assessment of chemicals and wastes, and restoration of environmental quality in village Bichhari in Rajasthan.

Environmental Systems Design, Modelling and Optimization

Evaluation of polyaluminium chloride as a coagulant in water treatment; reorganization of water supply system in Greater Jammu; studies on contamination of French wells in Ahmedabad; removal of pesticides from potable water; removal of excess fluorides from industrial effluents; design of biological waste treatment system for coke oven effluent at Visakhapatnam steel plant; grit analysis for

design of outfalls at Worli and Bandra; design of common effluent treatment plants for industrial complexes in Tamil Nadu, Karnataka, Gujarat, Maharashtra, Uttar Pradesh and Andhra Pradesh; resource recovery from coconut husk; wastewater treatment using constructed wetlands; solid waste management in Greater Bombay and Faridabad Industrial Complex; biotechnological reclamation of manganese and coal mine spoil dumps using domestic and industrial wastes; fuzzy description of river water quality; and agreement index of water consumption, are some of the contributions in the area of optimal environmental systems design.

Environmental Impact & Risk Assessment, and Environmental Audit

The R & D projects in this area included: risk assessment of caprolactam plant at FACT, Kochi; off-site emergency preparedness plan for Visakhapatnam district; environmental impact of second Madras water supply project at Veeranam; environment management plan for Bombay sewage disposal project; air pollution studies to redefine Taj trapezium; environmental impact studies at the Indian permanent station *Maitri* in Antarctica; carrying capacity studies in Doon Valley, Damodar basin and National Capital Region; development of knowledge based system for environmental impact assessment of industrial projects; and environmental audit of industrial projects.

Environmental Impact Studies at Antarctica: The Department of Ocean Development included NEERI in December 1993 in the 13th and subsequent expeditions to Antarctica to conduct environmental impact assessment studies at *Maitri* (70°42'S and 11°44'E). The reconnaissance survey carried out



Removal of crude oil spill by alkali treatment sawdust

Patents Filed

The patents of the following processes were filed by NEERI during 1994:

- Improved process for the recovery of 2,3-butanediol from fermentation broth
- Process for the demulsification of oil in water emulsion for the recovery of oil
- Process for production of new biosurfactant
- An improved process for cellulase production
- Process for the purification of coke oven waste water
- An improved process for the purification of waste water containing pollutants especially cyanide
- An improved skimming process for crude oil using alkali-treated saw dust
- Process for preparation of a DNA molecule useful for bioremediation of industrial wastes and wastewaters
- Process for the purification of textile wet process house wastewater
- Improved process for desulphurization of coal
- Process for desulphurization of gases laden with hydrogen sulphide □

Technology Transfer

The technologies transferred to industry by NEERI during 1994 include:

- **Screw Jet Aerator** to M/s Analyzer Consultium & Construction (P) Ltd.
- **Auto-Exhaust Smokemeter** to M/s Envirotech Instruments (P) Ltd.
- **Respirable Dust Sampler** to M/s Envirotech Instruments (P) Ltd. □



Biopolymer from whey waste through *Alcaligenes eutrophus*

during the 13th Expedition (December 1993 to April 1994) by the institute was addressed to the identification of hot spots; investigations on pollutant generating sources; characterization of water at Priyadarshini (Zub) lake and surrounding surface waters with reference to abiotic and biotic parameters; quantification of organic pollutional loads; microcosm studies on impacts of enhanced nutrients on lake plankton; and evaluation of present waste management practices.

Environmental Policy Analysis

Cleaner technologies for industrial production. Adoption and promotion of cleaner technologies in India has so far been considerably impeded by the lack of information among the user industries regarding opportunities available for pollution control and prevention. A centralized database on availability of and accessibility to cleaner technologies alongwith their economic evaluation does not exist in India. The institute undertook the task of generation of information

package on cleaner technologies in April 1991, at the instance of Central Pollution Control Board.

The information available nationally and internationally has been scanned through analysis of published literature, accessing established databases, interacting with the R & D centres within industries, industry associations, and eminent experts in the field as also the technical wings of financial institutions. As a part of the project, over 1000 research papers/documents have been scanned for details on cleaner technologies. The data collection/collation activities are in the case studies format standardized by United Nations Environmental Programme for ensuring harmonization.

Information on 510 case studies has been collected for 14 industry sectors. Analysis of the case studies in terms of waste minimization and end-of-pipe treatment options is also available. The software package CTBASE has been developed in FOXBASE for on-line

information storage, editing, and retrieval of case studies.

Local Area Network

The centrally located state-of-art high performance computer system comprising three HP-9000/730 workstations is presently catering to the R&D needs of the institute in the areas of environmental impact and risk assessment; and systems design, modelling and optimization through digital image processing of remotely sensed data and generation of thematic information for conducting the carrying capacity-based developmental planning studies; development of knowledge-based decision support systems for environmental impact assessment; and



Laboratory model for continuous production of biosurfactant

MoUs Signed by NEERI During 1993-94

- Oil & Natural Gas Corporation, Dehradun, for enhancement of environmental quality around oil and natural gas exploration and processing sites
- Mitsui & Co. Environmental Engineering Trust (MEET) for development and dissemination of environmental preservation technology, and to undertake joint Research & Developmental studies on various measures related to environmental protection with Japanese institutions
- Secede Engineers & Consultants Pvt. Limited, Madras, for enhancement of environmental quality through various projects and action plans
- Grindwell Norton Limited, Bangalore, for enhancement of environmental quality through various projects and action plans
- Wiley Eastern Publishers Limited, New Delhi, for development and publication of a series entitled 'Environmental Science and Engineering'
- Enviro Science & Engineering Pvt Limited, Madras, for enhancement of environmental quality through various projects and action plans
- Reliance Industries Limited, Bombay, for enhancement of environmental quality around RIL production plants, storage & warehouses through various projects and action plans
- Energy Management Centre, New Delhi, for conducting studies on energy recovery from wastes, in the area of policy research, and in the development of complimentary energy & environmental audit of industrial units
- National Institute of Urban Affairs, New Delhi, for carrying capacity-based developmental planning studies in Doon Valley
- National Institute of Urban Affairs, New Delhi, for carrying capacity-based developmental planning studies in National Capital Region
- University of Roorkee, for remote sensing studies for carrying capacity-based development planning in the Doon valley
- Oil India Limited (OIL), Rajasthan, for studies on comprehensive environmental impact assessment for proposed Gas Gathering Station at Dandewala in Jaisalmer district
- Nobletech Engineering Pvt. Limited, Kochi, for the preparation of process package for wastewater management, detailed engineering, commissioning, and training of manpower

□

development of software using a host of computer programming languages as also mathematical, statistical and graphics libraries.

With a view to facilitating the use of this large computing facility and number crunching power to individual working groups, a local area network (LAN) based on ETHERNET has been established. The LAN enables sharing of more powerful centrally located hardware and software resources from distributed locations of individual working groups (nodes) through PCs or X-terminals without duplication of cost intensive hardware and software at these nodes.

Additionally, the LAN facilitates the use of electronic mail service for quicker flow of R&D information amongst scientists not only in the country but also internationally through the SARNET and ERNET gateways.

International Collaboration

The institute is pursuing several joint R&D ventures in collaboration with United Nations Environmental Programme and World Health Organization. The institute is designated as the WHO Collaborating Centre in Environmental Health. It has also been nominated as a Regional Centre in India for the Commonwealth Science Council Project on Management and Disposal of Hazardous Wastes. The institute signed an MoU in September 1993 with Mitsui & Co. Environmental Engineering Trust (MEET) to undertake joint research and developmental studies with Japanese institutions on various measures related to environmental protection.

During the year 1994, nearly 70 papers were published in national and international journals and 88 papers were presented in conferences/seminars/symposia. □

Seminars, Symposia & Workshops

Corrosion Control

THE National Corrosion Council of India organized the Fifth National Congress on 'Corrosion Control' during 19-21 April 1995 in New Delhi, in collaboration with the Central Electrochemical Research Institute, Karaikudi, and NACE - International (India section). The aim of the congress was to focus on recent developments on various aspects of corrosion and its control. There were 10 invited lectures by eminent personalities in the field. More than 150 papers on the following areas were presented in two parallel sessions: Protective Coatings; Corrosion in Concrete; Materials Selection for Different Industrial Sectors; Marine Corrosion and Biofouling; Cathodic Protection; Corrosion Monitoring and Control; Weldment Corrosion and Failure Analysis; Inhibitors; and Fundamentals of Corrosion. About 300 delegates representing more than 80 different industries, R & D and academic institutions participated in the congress.

Inaugurating the congress, Prof. S.K. Joshi, the then Director General, CSIR, stated that corrosion research is one of the thrust areas of CSIR and CECRI has immensely contributed to the development of various anti-corrosion products and processes, besides creating awareness among the industries by arranging training programmes every year. He also mentioned that CSIR has formed Bridge Engineering Consultancy Group involving a number of CSIR laboratories for condition survey and monitoring of major bridges with the help of the Ministry of Surface Transport. He referred to the huge annual losses to the country owing to corrosion, esti-

mated to be around Rs. 150,000 million and pointed out that 20 - 25 % of these losses could be avoided by mere application of the existing knowledge on corrosion control. He also appreciated the steps initiated by the National Corrosion Council of India towards updating the Corrosion Map of India, and the introduction of corrosion survey and audit in various industrial sectors with a view not only to bring down the economic losses due to corrosion but also to improve the efficiency and avoid hazards to the environment. These are some of the vital issues which affect the durability of important infrastructures like bridges, industrial and power plants and transport systems. He assured that CSIR would support the major decisions taken at the congress. The present philosophy of CSIR envisages active involvement of various industrial sectors so that any programme or project undertaken by the Council would be useful to the nation at large, he added.

In his Presidential address, Prof. G.V. Subba Rao, Director, CECRI, highlighted R&D activities of CECRI in the field of corrosion. He stated that CECRI is fortunate to enjoy the interaction with a large number of industries which have come forward to sponsor research programmes or make use of the consultancy services.

Dr H.R. Bhojwani, Adviser, Technology Utilization Division, CSIR, and Chairman, Organizing Committee of the Fifth Congress, welcomed the gathering. Dr. N.R. Rajagopal, Head, Human Resource Development Group, CSIR, and Chairman, Souvenir Committee, released the Directory of Anti-Corrosion Products and Processes on this occasion. Dr. K. Balakrishnan, Dy. Director, CECRI, and Chairman, NCCI, traced the origin of the National Corrosion Council of India and described its activities

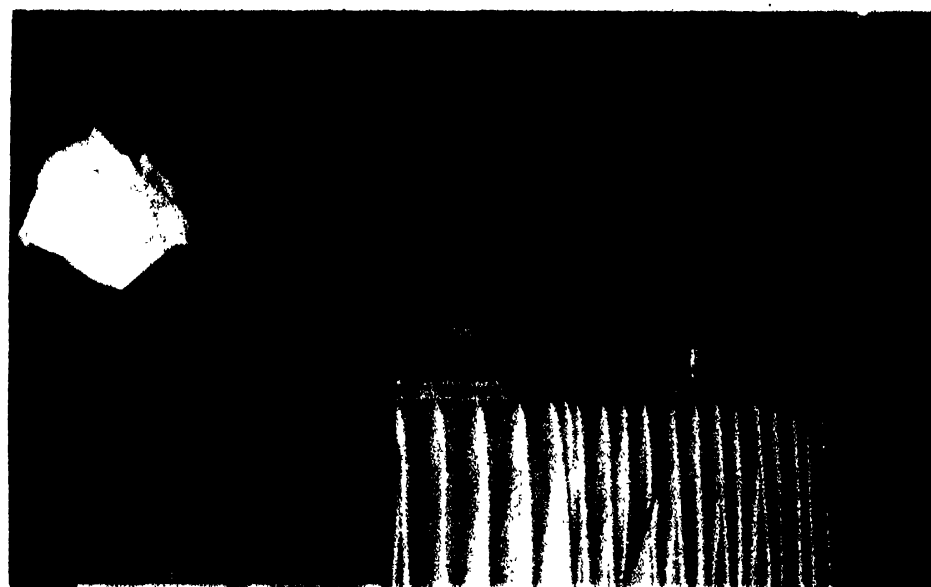
since inception. Besides publishing the *Corrosion Update* and Directory of Anticorrosion Products and Processes, NCCI is creating awareness about the need for corrosion audit in the major sectors and for the preparation of corrosion map of India. He stated that the corrosion survey and audit of the existing structures would greatly help in extending the useful life of the existing infrastructures, besides ensuring safety.

Prof. K.I. Vasu, former Director of CECRI and Founder Patron of NCCI, released the souvenir brought out on this occasion. Shri O.P. Degan, Chairman, NACE-India section, released the special issue of *Corrosion Update*. Shri P.F. Anto, Vice-Chairman, NCCI, read out the messages received from eminent personalities.

Prof. E.S. Raja Gopal, Director, NPL, and Patron, Organizing Committee, Dr N.S. Rangaswamy, Assistant Director, CECRI, and Co-chairman, Souvenir Committee; Dr A.K. Sood, Director, DST; and A.S. Khanna, Secretary, NACE-India section, offered felicitations.

On 20 April, the National Corrosion Council of India organized a brain-storming session drawing representatives from important industrial sectors, government departments as well as academic and research institutions to consider such major issues as the preparation of corrosion map of India, national survey of cost of corrosion, standards for anti-corrosion products and processes, establishing a National Corrosion Testing or monitoring facility as per standards, condition survey and monitoring of major concrete bridges under distress.

After detailed discussions on various aspects, the panel made the following recommendations: **Corrosion Map of India:** A commit-



Prof S.K. Joshi, the then Director General, CSIR, giving the inaugural address at the Fifth National Congress on Corrosion Control

tee headed by Prof. G. V. Subba Rao and Prof. K.I. Vasu will be formed to draw an action plan. NCCI will provide the seed money for creation of a secretariat at CECRI. Appeals will be made to various government departments as well as industrial sectors for active participation in the above activities and for contribution to the corpus fund. **Corrosion Survey and Audit:** For National Corrosion Survey, industrial sectorwise committees will be formed for assessing the cost of corrosion under each industrial sector. The NCCI will formulate a suitable proforma for finding out the cost of corrosion in each industry. A separate committee will be formed for preparation of a detailed project proposal indicating the locations of study, materials and protective systems to be evaluated, agencies for implementation and cost estimate for an initial project of three years' duration. This committee will also involve the Department of Environment and Department of Meteorology. Attempts will be made to forecast. CSIR, DST, DOE, etc., have to be

approached for providing support to the above activities and also nominate their representatives to serve in the committee. **Corrosion Control of Concrete Structures:** Analyzing the causes of failures of some of the major concrete structures, the panel recommended that apart from disseminating knowledge on various protective measures, adequate steps should be taken to caution civil engineers and builders on the need for implementation of strict guidelines for the preparation of durable concrete. **Corrosion Education and Awareness:** The panel called for making people aware of the corrosion hazards through mass media and introduction of academic programmes on corrosion science and engineering. □

Powder Metallurgy

THE Twentyfirst National Powder Metallurgy Conference organized by the Powder Metallurgy Association of India in collaboration with the Central Glass & Ceramic Research Institute, Calcutta,

was held during 27-28 April 1995 at Calcutta. The conference was inaugurated by Prof. Sankar Sen, Minister of Power and Science & Technology, Government of West Bengal. In his welcome address Dr. B.K. Sarkar, Director, CGCRI, outlined the significance of the conference which was being held for the first time at his institute. Prof. Sankar Sen inaugurated the conference with an illuminating speech that covered both the technical and social aspects of such a meet. He reminded the audience about the present liberalization policy of the government, which is bearing some fruit, although its benefits are being mostly enjoyed by the urban population of the country. These benefits should be brought down to the grass root level, he said.

In his Presidential address, Prof. P. Ramakrishnan traced the history of powder metallurgy from the early Roman period to its present form. Hi-tech use of powder metallurgy in this age represents much more advanced techniques developed through decades of research and development. Students, scientists and

technical experts from both India and abroad participated in the conference making it a great success. Technical personnel from industries also took part in the conference and delivered lectures on the subject. An exhibition was held on this occasion in which the products of CGCRI were displayed. Industries also put up a good show of their products. Prof. Sankar Sen went round the exhibition and expressed satisfaction over the progress made in this direction by the institute as well as industries.

Two memorial lectures were delivered and seven technical sessions spread over two days were held. R.V. Tamankar Memorial Lecture delivered by S.L.N. Acharyulu, Director, DMRL, Hyderabad, stressed on the cost, quality, environmental and novel processing aspects of powder metallurgy products with particular emphasis on end user agencies such as automobile sectors, defence and aerospace activities. In P.R. Roy Memorial Lecture delivered by Dr. B. K. Sarkar, the intrinsic nature of interdependence between particle shape and size of

powder microstructure, impurities and the life expectancy of powder metallurgy components with particular reference to consolidation of nanomaterials were discussed. The Association felicitated Dr. B.K. Sarkar for his significant contributions to the growth of powder metallurgy in India.

Among the various notable lectures given by various experts, the important area of carbide-based conventional cutting tools and the emerging area of ceramic cutting tools were covered by Dr. A.S. Chowdhury of the India Hard Metals, Calcutta, and Prof. A.B. Chattopadhyay of IIT, Kharagpur, respectively. Prof. R. Prummer of Germany detailed on novel processing techniques such as explosive shock wave consolidation while Mr. R.P. Reed of USA overviewed the most recent advances in injection moulding of powder metallurgy components and superalloys. The wide range of activities on powder metallurgy materials developments in Indian laboratories, R&D institutes and industries covered issues as diverse as sintered bronze graphite plates for electronic instrumen-



Prof. Sankar Sen, Minister for Power, Science and Technology, Government of West Bengal, delivering the inaugural address at the 21st National Powder Metallurgy Conference (left). Dr B.K. Sarkar, Director, Central Glass and Ceramic Research Institute, Calcutta, showing products developed by the institute to Prof. Sankar Sen, Minister for Power, Science and Technology, Government of West Bengal (right)

tation to particle size effect in nickel base superalloys to the preparation of uranium dioxide pellets without pore-forming additives. Interesting work in progress at CGCRI on the development of oxide ceramics cutting tools and bio-materials for total hip replacement was presented vividly by Shri A. Dasgupta and Shri A. Chanda respectively. Best Powder Metallurgy Awards for Industrial Product and Research Paper were won respectively by M/s. Eastern Diamond Products Ltd, Calcutta, and M.C. Somani and M. Kumar of DMRL, Hyderabad. □

Applications of Supercomputing

TO make CSIR scientists aware of the usefulness of supercomputing in their projects as well as of the capabilities available at the CSIR Centre for Mathematical Modelling and Computer Simulation (C-MMACS), Bangalore, a meeting on 'Scientific Applications of Supercomputing' was held on 14 April, 1995 at the National Aerospace Laboratories, (NAL). Fifty-two scientists, including a few distinguished guests and invitees, participated in the deliberations. Nineteen CSIR institutions were represented.

In his opening remarks, Dr K.S. Yajnik, Head, C-MMACS, said that in recent times there has been increasing emphasis on simulation of complex phenomena and systems for addressing major contemporary problems in science and technology. Since its inception in 1988, the primary objective of C-MMACS has been to develop and provide expertise and facilities for modelling and simulation of a wide range of natural and engineering systems. Supercomputing facility at C-MMACS has the capability to deal with scientific problems which

require vectorization, parallelization and optimization.

The meeting was inaugurated by Prof. S.K. Joshi, the then Director General, CSIR. He set the tone of the meeting by emphasizing the need for using supercomputing facilities existing at C-MMACS by all CSIR laboratories to achieve the set goals. He specially mentioned the need of supercomputing in drug design, molecular modelling and global climatic change. He called for making use of computers for value-added applications, establishing data-links between CSIR institutions, and computing through remote login (wide area network). Marketing of software capabilities developed by various CSIR labs and the role C-MMACS can play in these matters should be examined, he added.

Dr V. Prakash, Director, Central Food Technology Research Institute, Mysore, and Dr K. Narasimhan, Director, Central Fuel Research Institute, Dhanbad, appreciated the achievements of C-MMACS. During the meeting, ex-

perts discussed various issues related to high performance computing and networking. The participants were introduced to the computing environment and facilities available at C-MMACS and National Aerospace Laboratories. Invited speakers discussed applications of supercomputing in the areas of molecular modelling and design, modelling of large scale oceanic circulation, finite element analysis and modern biology.

In a separate session, representatives from eight laboratories briefly mentioned the ongoing computational activities, potential areas of future applications of high performance computing, and the facilities required to pursue projects in their laboratories. The active participation of scientists from various laboratories in the deliberations of the meeting brought forth many issues of concern and helped understand the complexity of high performance computing in CSIR laboratories. They also discussed the operational problems in using such facilities and the need



Shri Thangavelu explaining supercomputing facilities at the CSIR Centre for Mathematical Modelling and Computer Simulation to the participants of the meeting on 'Scientific Applications of Supercomputing'.

to work further to find solutions to these problems.

Issues such as data-links between CSIR laboratories and the progress in establishing networks (RENNIC) were also discussed. It became evident that issues related to marketing of expertise and software developed by CSIR laboratories need a closer look. Although it may not be the primary objective of a specific laboratory, efforts need to be made to identify software capabilities which have potential for marketing and commercial exploitation. However, such a project has to be driven by the needs of users.

Dr K.N. Raju, Director, NAL, emphasized that the cost of dressing up and packaging a software is substantial and separate funds need to be provided for such an activity. He also suggested that C-MMACS should look into the possibility of developing expertise in this field.

Taking into account inputs provided by various representatives and suggestions made by experts, the following proposals were recommended for further action:

(1) The groups working in various areas related to high performance computing in a laboratory should be brought together. The Director of the laboratory and two/three scientists from C-MMACS should be called to such a meeting. The programme of such a meeting should be chalked out on the basis of requirements of individual laboratories; (2) Networking needs of individual laboratories, especially with reference to the remote-login with C-MMACS, should be looked into. To start with, linkage through dial-up mode can be experimented. Remote login facility to the C-MMACS computer through dial-up lines is at present available. However, Internet connectivity should be used wherever

and whenever possible; (3) Training courses designed for software developmental activities, including menu based programming, C++, etc., should be planned for CSIR scientists during the next one year; (4) Special meetings to discuss strategies for marketing software should be called. These meetings should include scientists interested in marketable software, software professionals, companies and representatives of C-MMACS and CSIR Headquarters; and (5) Workshops of short durations for demonstrating the setting up of a dial-up mode for remote login should be organized for the interested representatives of CSIR.

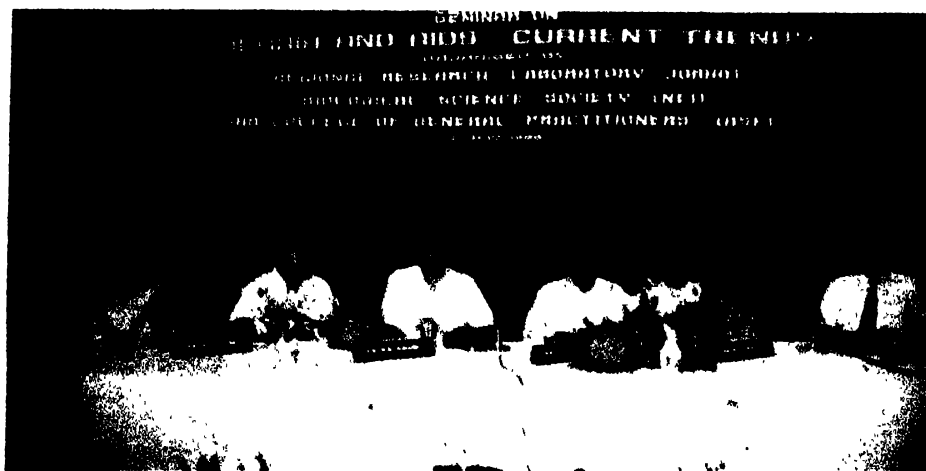
Dr M.W. Pandit briefly summarized the deliberations of the meeting. The meeting concluded with a vote of thanks. □

Malaria and AIDS : Current Trends

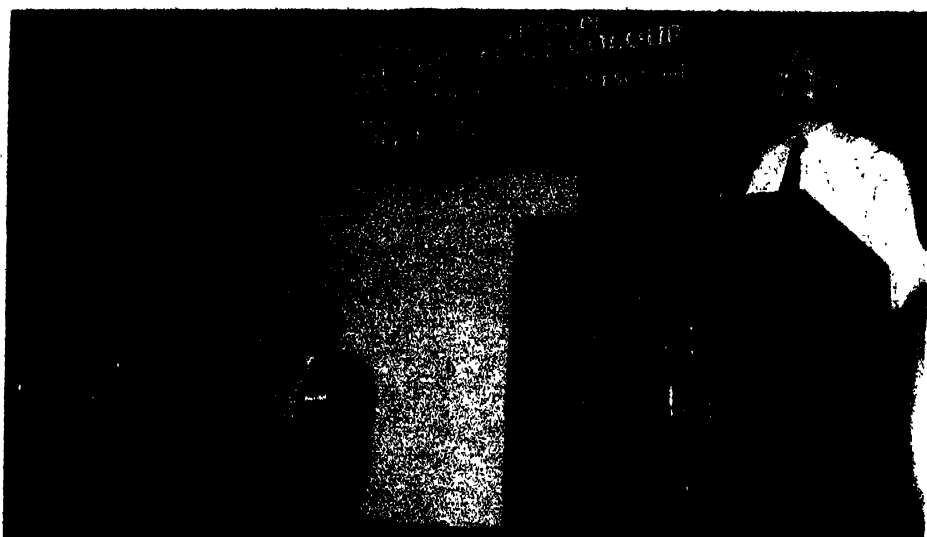
A seminar on 'Malaria and AIDS: Current Trends' was organized jointly by the Regional Research Laboratory, Jorhat, Biological Science Society of North East India and Indian Medical Association College of General Practitioners.

ners (IMACGP) in the RRL auditorium. Inaugurating the seminar Dr Anil C. Ghosh, Director, RRL-Jorhat, expressed his concern on the recent outbreak of malaria in several parts of Assam. He emphasized the need to study the basic causes of recurrence of malaria in the epidemic form so that it may not occur again. He observed that due to non-availability of modern equipment and laboratory facilities, proper diagnosis cannot be done in time and therefore diagnostic facilities in hospitals are a must. Dr Ghosh also spoke on the achievements of the laboratory in developing drugs to combat malaria. He pointed out that the rich flora of North-East is the storehouse of many vitally important medicinal plants. For example, he referred to hypericum from which anti-AIDS drug can be manufactured.

Dr Amio Kr. Sarma, Hony. Secretary of the Indian Medical Association College of General Practitioners, gave a historical account of malarial diseases with special reference to North-East India, their resurgence, life cycles of various parasites responsible for causing malaria and the physiological and biochemical changes



Seen on the dais during the seminar on 'Malaria and AIDS: Current Trends' (from right) are: Dr Anil C. Ghosh, Dr D. Paul, Dr A.R. Baruah, Dr A.K. Sarma, Dr D. Sarma and Dr R.K. Mathur



Intensive course on 'Applications of Remotely-sensed Data on Ocean Colour' in progress

that result due to infection of malaria parasites. The need for better techniques to ascertain various types of malaria was also emphasized. He also urged for the destruction of breeding grounds of mosquitoes as a primary step for controlling malaria, by applying DDT and other common insecticides. Dr Dipok Kr. Sarma of IMACGP spoke on the government's Malaria Control and Eradication Programme which was started in 1958 and was quite successful in controlling malaria in the country. He emphasized the need for constant research to monitor the occurrence of malaria epidemic. He also spoke on the symptomatology of diagnostic procedure and treatment of malaria with different kinds of medicines. He highlighted the effectiveness of quinine, chloroquine and Chinese wonder drug 'How Chouo' and 'Haojuentivhe' in the treatment of malaria, and the advancements made in the development of anti-malaria vaccine, such as, Sporozole, Blood stage vaccine, etc.

Dr D. Paul, Professor and Head, Department of Medical Microbiology, All India Institute of

Hygiene & Public Health, Calcutta, who is an eminent expert on AIDS in India, gave a detailed historical account of the outbreak of AIDS disease in the USA, its fast spread to different parts of the world, major spreading mechanism, isolation of the virus, classification of the virus, symptoms in infected persons, mechanism of transmission, and the steps taken by different countries to prevent AIDS. He also spoke on the prevailing situation in some parts of South-East Asian countries and the present scenario in India; the latest step taken by the Health Department, Government of India, to develop anti-AIDS drugs; and progress made so far in different parts of the world.

The session was followed by a lively brain-storming panel discussion. The queries from participants were attended by experts like Dr D. Paul, Dr A.K. Sarma, Dr J. Mahanta, Dr D. Handique, Dr N.M. Rafique. Dr Dipok Sarma acted as a moderator in the panel discussion. Dr Anil C. Ghosh summed up the proceedings and Dr R.K. Mathur proposed a vote of thanks. □

Training Courses

Applications of Remotely Sensed Data on Ocean Colour

PRIMARY production is the first link in the marine food chain. An accurate estimation of the primary production has several implications. Firstly, it gives an indication of the amount of food available for higher forms of marine life and, secondly, it plays a significant role in the thermodynamics of the mixed layer. Due to the poor spatial and temporal coverage possible by the conventional methods, satellite imagery has become an invaluable tool for the estimation of primary production.

The Department of Ocean Development (DOD) along with seven international agencies (COSTED, IOC, JGOFS, ROSTAS, SAREC, SCOR, START and UNESCO) sponsored an 'Intensive Course on the Applications of Remotely Sensed Data on Ocean Colour' in Bangalore during 3-7 April 1995. The course was organized by the CSIR Centre for Mathematical Modelling and Computer Simulation.

Fifty scientists, including 22 from 18 different countries, participated in the course. The course was inaugurated by Dr K.N. Raju, Director, National Aerospace Laboratories, Bangalore. Prof. V.K. Gaur presided over the valedictory function, and Dr B.L. Deekshatulu, Director, National Remote Sensing Agency, and Chairman, Indian Committee for IGBP, delivered the valedictory address.

Dr Shubha Satyendranath, Dalhousie University, and Dr Trevor Platt, Bedford Institute of Oceanography, both eminent researchers in the area, were the instructors for the course. The topics covered included a hierarchy of al-

gorithms of varying complexity to estimate primary production (i.e. non-spectral, spectral available light and absorbed light models), determination of total water column productivity, extrapolation of local algorithms to regional and basin scales and the use of ocean colour as a tool in modelling of the mixed layer processes and biogeochemistry of the ocean. Invited talks were delivered by the participants on instrumentation and sensors and application of ocean colour data.

The feedback from the participants reflected their appreciation for the course and its timeliness in view of the imminent launch of the SeaWIFS and other ocean colour satellites. □

Water Quality and Fluorosis

A training course on 'Water Quality with Emphasis on Fluorosis' at Ambala Cantt was jointly organized by PWD (Public Health) Circle, Ambala, and the Industrial Toxicology Research Centre, (ITRC), Lucknow, during 6-10 March 1995. The trainees included public health engineers, medical doctors and chemists.

In his inaugural address Shri S.S. Bola, Chief Engineer, Public Health, Government of Haryana, Chandigarh, emphasized the importance of water quality monitoring and feedback data from the laboratories using portable water analysis kit developed by ITRC, Lucknow. Shri Chadha, Ex-Chief Engineer, expressed his views on water quality. Shri D.K. Jain, Superintendent Engineer, PWD, PH circle, Ambala, welcomed the delegates and the faculty. Stressing the importance and relevance of the training course, Dr. Krishna Gopal, Head, Aquatic Toxicology,

ITRC, highlighted the contributions and expertise of ITRC in water quality analysis, including the development of suitable technologies. He also gave an overview of the activities of the centre since the inception of Rajiv Gandhi National Drinking Water Mission of the Ministry of Rural Development, Government of India.

In his lecture Dr. V. Behari, Scientist, Epidemiology Section, ITRC, talked about the water borne diseases and recommended preventive measures. Shri Sanjay Kumar, Scientist, ITRC, delivered an informative lecture on sampling, transportation and preservation of water samples. He emphasized the need for early sample analysis. He also discussed the various methods of fluoride estimation in water, their limitations, the interfering ions, and methods to avoid inter-

ferences that prevent accurate fluoride estimation in the presence of these ions. Shri Kumar also discussed the available techniques of defluoridation of drinking water.

Dr. V.P. Sharma, Scientist, ITRC, discussed the physico-chemical analysis of water, latest instrumentation and the precautions that should be taken while performing the tests in the laboratory. Dr. Krishna Gopal, Scientist, talked about the bacteriological analysis of water and the status of water quality in different parts of the country. He also discussed the possible formation of trihalomethane due to the use of chlorine as disinfectant and discussed the various other methods of disinfection.

New Aircraft Design Centre at NAL

A new Centre for Civil Aircraft Design and Development (C-CADD) came into being on 1 June 1995 at the National Aerospace Laboratories, Bangalore. The centre, which is the logical 'upgrade' of the erstwhile Civil Aviation Unit, has a management structure designed to give a big boost to all civil aviation-related activities, especially those related to the development of Saras aircraft. The basic objectives of the centre are:

- To bring under one roof the two aircraft (Hansa and Saras) development projects utilizing the available resources optimally.
- To plan in advance other projects such as the stretched versions of Hansa, Saras, etc.
- To study the air-worthiness and certification aspects and liaise with DGCA on a continuous basis for certification of aircraft designed and developed at the centre.
- To plan technology development by liaising with various divisions of NAL and promote forward-looking research programmes of direct relevance to civil aviation.
- C-CADD will also be involved in the marketing efforts for the aircraft developed by the centre.

Dr. M. Shivakumara Swamy will head C-CADD and Dr. V.K. Narayan will be its joint Head.

A technical session was held for resolving the problems of the trainees in field conditions. A field visit to the water treatment plant at Ambala was also organized to acquaint them with methods for collection of samples. The ITRC team along with Dr. (Smt) Anita Suneja of Government Hospital, Sonapat, visited Ganaur (Sonapat), to obtain the baseline information on fluorosis in the area. The team noticed visible signs of dental fluorosis in school children in the age group of 6-14 years. In a survey, four out of five tubewells used for drinking water were reported to have the level of fluoride above the permissible limit prescribed by WHO for human consumption! □

A technical session was held for resolving the problems of the trainees in field conditions. A field visit to the water treatment plant at Ambala was also organized to acquaint them with methods for collection of samples. The ITRC team along with Dr. (Smt) Anita Suneja of Government Hospital, Sonapat, visited Ganaur (Sonapat), to obtain the baseline information on fluorosis in the area. The team noticed visible signs of dental fluorosis in school children in the age group of 6-14 years. In a survey, four out of five tubewells used for drinking water were reported to have the level of fluoride above the permissible limit prescribed by WHO for human consumption! □

Announcement

Publication of Industry Meet-cum-Seminar on Conservation, Intellectual Property Rights and Trade in Medicinal and Aromatic Plants. To be held during 15-17 November 1995, the Seminar will focus on the current status, emerging trends, interest and demand for greater use of plant-based drugs. It will discuss issues relating to biodiversity, over-exploitation and conservation; domestic and international trade practices; impact of intellectual property rights in the new patent environment; and present policies and regulations on drug development.

The seminar envisages interaction, coordination and exchange of information among researchers, entrepreneurs, policy makers, planners, S&T managers, drug dealers, cultivators, government agencies and others interested in medicinal and aromatic plants.

Organizing Committee: Dr G.P. Phondke (Chairman), Dr T.K. Mukherjee (Convenor). **Last date for receipt of abstracts:** 30 September 1995.

For registration forms and any other information, please write to: The Convener, Industry Meet-cum-Seminar on Conservation, Intellectual Property Rights and Trade in Medicinal and Aromatic Plants, Publications & Information Directorate, Dr K.S. Krishnan Marg, New Delhi-110 012; Telephone: 5726613, 5788301.

Deputation Brief

D. Vasudevan

DR D. Vasudevan, Scientist, Central Electrochemical Research Institute, Karaikudi, went to Germany under the German Academic Exchange Programme (DAAD). He worked in the area of superoxide electrochemistry under the guidance of Prof. Dr. H. Wendt of

Chemische Technologie at Darmstadt, Germany, from June 93 to March 95.

His research work concerned superoxide generation and its reactivity with 17 different organic halides in aprotic media. A detailed investigation was made to understand the nature and mechanism of the reaction between superoxide ion and various classes of the organic halides. Also, peroxides (dialkyl peroxide and alkyl hy-

US firm to market CSIR knowledgebase

THE Council of Scientific & Industrial Research has signed a memorandum of understanding with M/s Global Exchange of Technology Inc. (GET), USA, on 15 May 1995 to market CSIR knowledgebase. The initiatives to integrate the Indian economy with the global economy and trade systems have opened up opportunities for the Indian S & T in the developed countries of Europe and North America. European and American companies are not only looking at India for investments and markets but also for a source of S & T knowledgebase. Due to its world class multi-disciplinary expertise, capabilities and facilities in selected sectors, CSIR has been amongst the first few R & D organizations to take advantage of this opportunity. CSIR has already forged R & D alliance with a number of well-known companies from different parts of the world.

GET is a professional technology exchange firm that keeps track of technological developments all over the world for use in USA or elsewhere. The umbrella MoU signed enables GET to negotiate and finalize business development and marketing proposals with 10 selected CSIR laboratories in the chemical sector for their specific knowledgebase. GET will offer CSIR's R & D output packaged in a form and format that is directly usable by clients.

The MoU was signed by Mr Joseph H. Sharlitt, P.C. Vice President, GET, and by Dr H.R. Bhojwani, Head, Technology Utilisation Division, CSIR, in the presence of Prof. S.K. Joshi, the then Director General, CSIR. It is envisaged that export of CSIR services and technologies will fetch \$ 5 million annually in two years' time. □

droperoxide) were generated from controlled potential electrolysis of oxygen in presence of added organic halide. Spectral, chromatographic and classical estimation methods were employed for analysis and quantitative estimation of the peroxides. Also, work on indirect Kolbe electrolysis was initiated. The electrolysis of hexanoic acid (neutralized partially) in oxygenated AN was carried out with Pt electrodes to yield the corresponding dimeric peroxide.

Dr Vasudevan also carried out work on molten carbonate fuel cell. Different anodic and cathodic materials were chosen and the cell performance was studied by measuring polarization, ohmic resistances and scanning electron microscopy. The electrochemically formed NiO (by galvanostatic or potentiostatic electrolytic formation) gave a good performance as a cathode. □

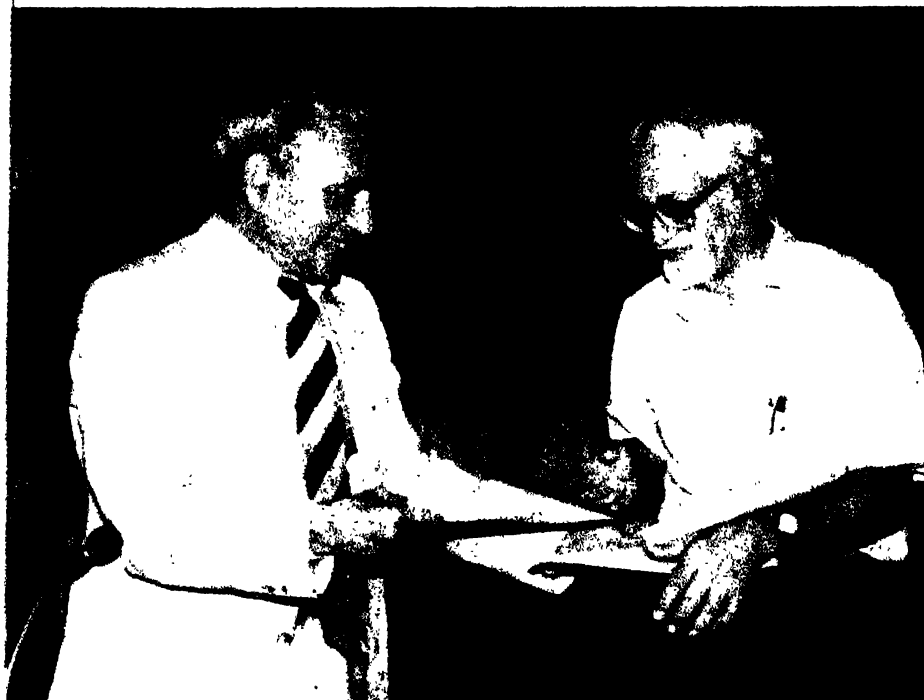
Honours and Awards

A.N. Mukherjee

DR A.N. Mukherjee of CRP Division, National Metallurgical Laboratory, Jamshedpur, has been elected a Fellow of the Electrochemical Society of India.

T.P. Pathak

SHRI T.P. Pathak of the Publications & Information Directorate (PID), New Delhi, has been chosen for an NCERT Award in the Twenty-eighth National Prize Competition for Children's Literature for the year 1994-95, for his book *Mein Hoon Hava* for children of age group 9-15 years. The award consists of a cash prize of Rs 10,000 and a plaque. □



Mr Joseph H. Sharlitt, Vice President, Global Exchange of Technology, USA, and Dr H.R. Bhojwani, Head, Technology Utilisation Unit, CSIR, exchanging the MoU document for marketing CSIR's knowledgebase in USA

Printed and Published by Dr G.P. Phondke, Director, Publications & Information Directorate (PID), Dr K.S. Krishnan Marg, New Delhi - 110 012
Printed at PID Printing Unit

Editors : Dr B.C. Kashyap, Dilip M. Sanyal and Madhu Sahni

Production : Kanchal Kishore

Annual Subscription : Rs. 60
Single Copy: Rs. 3.00

Phone: 5786301

Gram: PUBLIFORM

Telex: 031-77271

E-mail: pid@simetd.ernet.in.

Fax: 5787062

RN 4512/57

CSIR

NEWS



VOL 45 NO 14 30 JULY 1995

IN THIS ISSUE

CSIR to stress Market-driven Research—An Interview with Dr R.A. Mashelkar 210

National Aerospace Laboratories R & D Highlights: 1994-95 213

New NIO Findings 216

IICT Golden Jubilee PM lauds IICT contributions 218

Commonwealth Science Council 220

Hansa-2 in the course of its inaugural flight (Top). A full scale mock-up of *Saras* (Bottom). A report on the R&D accomplishments of the National Aerospace Laboratories, Bangalore, during 1994-95, appears on page 213.

CSIR to Stress on Market-driven Research

As Chairman of the Committee on Marketing of CSIR Knowledgebase, Dr R.A. Mashelkar had made several specific recommendations for bringing CSIR closer to industry, improving its market orientation, and ensuring that its marketability increases. Now, with his taking over as Director General of CSIR, he also gets an opportunity to implement these recommendations, which have been recently accepted by the Governing Body of CSIR.

Speaking to Dr B.C. Kashyap, Editor, CSIR News, Dr Mashelkar outlines his policy initiatives for bringing CSIR, the world's largest R&D organization with 40 laboratories and 27,000 employees, up to its real potential:

BCK: What new policy initiatives do you propose to take?

RAM: I must say that many of them will stem from the initiatives my predecessor, Dr S.K Joshi, had taken in the light of Mashelkar Committee Report. I will therefore prefer to call it a Joshi-Mashelkar action plan! The Mashelkar Committee Report, which has been recently accepted by the CSIR Governing Body, contains several recommendations on restructuring, reforms, etc., which would lead to improving our contact with industry, our market orientation and marketability. When we talk in terms of market orientation and marketability, it essentially means that we want to look at R&D as a business. And in today's world, business is done in a very competitive way. The delivery of technology has to be in terms of time and quality by international standards. We need to create a culture and an incentive framework so that this becomes possible.

This process has been already initiated. We have introduced an incentive scheme of giving 40% of the net royalty/premium to the scientist(s) whose invention has reaped commercial benefits. The financial limits for consultancy have been removed; the only limit now is on time, i.e. 50 mandays.

CSIR scientists can be on the Board of Directors of private companies now. This would help them absorb and induct a corporate culture in CSIR. The companies will also be benefitted. Because in most of these board meetings today aspects such as finance, management and marketing are discussed, but technology does not get discussed. Now, with technically-oriented directors on the boards, they would be able to discuss technology as well.

A few select laboratories would be allowed to set up 'commercial arms', which could be societies, foundations or section-25 companies. This will help marketing of technologies in an efficient manner. The selection of laboratories for this purpose would be done on the basis of certain criteria, e.g. their track

record in terms of market-oriented research, industrial earnings over the past years, etc.

We also need professionals, the technology facilitators, who do technology marketing, draw up professional contracts, file tight patents, etc., and we need to create conditions so that they will be attracted to CSIR.

We would also take steps to bring in professionalism in administration, finance, stores & purchase and the rest of the support structure since the speed and quality of delivery will very much depend on this support. For instance, the people in Stores & Purchase should be experts in materials management endowed with all the modern tools. We are going to pay considerable attention to human resource development, not just in the case of scientists & technologists but all the members of CSIR family.

We would give maximum freedom and flexibility to the laboratories. There would be autonomy but also accountability. The role of CSIR Headquarters would be to facilitate and catalyze. We do not want to have the functions of control anyway.

BCK: With emphasis on market-driven research and revenue generation, will the funding to basic research be reduced?

RAM: As Louis Pasteur has said — there is nothing like basic and applied science. There is basic science and then there is an application of science. There is no question of reduction in funding to what I call as relevant scientific research, i.e. the research which is novel, non-obvious and useful. Our focus has to be on problems that need to be solved rather than those that can be solved. Rather than studying problems, we should be solving problems. What we really need to do is *scientific industrial research*, that is, industrial research which is based on absolutely top class cutting edge science.

BCK: Now that we are talking about relevant research, does it mean that we would not do exploratory research?

RAM: Exploratory research is investment into future. How can I stop investment into future? Special funds will be earmarked for exploratory research, even for exploring crazy ideas. Special emphasis will be on using the criteria of unusual creativity and excellence. No 'derivative' research should be supported.

BCK: How would we judge the relevance of basic research at the initial stage when its utility usually becomes known after a long time?

RAM: Some fraction of our research must be on long-time horizons. I am not saying that you give us a product tomorrow. You may give it after 10 years from now. But the eventual economic sense of science

will have to be kept in mind. We have this wrong notion that pure science cannot be valued in terms of the wealth that it can create. In Weisman Institute in Israel, an outgrowth from number theory was patented by a pure mathematician — and due to its consequences in some special applications in information technology, it was licensed out. The mathematician as well as the institute reportedly earned several million dollars. Why can we in CSIR not do it? The idea again is to do science of the highest class — but wherever possible, do keep an eye on creation of wealth — not only intellectual but material also. The nation benefits, CSIR benefits and the scientist benefits too!

BCK: This is interesting and brings us to the issue of patents. The number of patents filed by India is very small, just around 3000 per year. Should not we be doing something to improve the patenting scenario in the country?

RAM: This is one of my major concerns. There is a lot of illiteracy in the field of patenting in our country. People are not able to read patents nor can they write patents; that is, when you read a patent, read it in such a way that you bypass it and create a new invention, and when you write a patent, write it in such a way that nobody can bypass it. There are no patent training institutes, trained attorneys or patenting professionals who could recognize and protect patent rights in the country.



Dr R.A. Mashelkar, Director General, CSIR, speaking to Dr B.C. Kashyap, Editor, *CSIR News*, about the policy initiatives that he is going to take to bring CSIR up to its real potential

So, there is a need to launch a National Mission on Patents to reform the patents offices, to set up an Intellectual Property Institute for creating a cadre of professionals, to create an international patenting fund, and to create awareness about the use of patent information services. I am going to have major investments to make CSIR very strong as far as patenting is concerned. And while doing this

for CSIR, we would contribute in every way that we can to create patent awareness throughout India.

BCK: You are going to lay a lot of emphasis on marketing by setting up 'commercial arms', inducting professionals, etc. What would be the roles of Technology Utilization Division, marketing wings in the laboratories, and NRDC in marketing the CSIR technologies?

RAM: 'Technology Utilization' has a connotation that first you develop a technology and then look for its utilization, which means we think in terms of being supply-driven and not market-driven. I want the word 'market' to come first. In fact, I want the word 'business' to enter CSIR in a big way. So, actually, we should be talking in terms of 'Business Development'. Technology is our business. Also, planning and business development should go together. So, we will merge these two activities together and form an R&D Planning & Business Development Division.

The most crucial role of marketing will be played by individual laboratories. We, at the Headquarters, will facilitate, but it is the people from marketing wings of the laboratories who would go out and be in touch with industry. We should not forget that it is the laboratories which have to be close to the market.

NRDC is a very good organization and I would like to ensure that CSIR and NRDC work together as closely as possible. But we should remember that NRDC deals with full-fledged packaged technologies, whereas CSIR offers, in addition to total packages, a lot of technical services, e.g. consultancy, testing, standardization, quality control, etc.

BCK: Professionals in technology management get much better salaries elsewhere. How would you get them attracted to join CSIR?

RAM: Basically, here we are talking about professionals, who would manage technology, a subject which is not well developed in the country as yet. The only place that I know where a course in Technology Management is operational is IIT-Bombay. I played some small role in setting up this particular course. We have to create a cadre of such people. Yes, they get great salaries outside. I think the only way we can get them attracted is by giving them exciting challenges and opportunities. We must remember that there are many scientists in CSIR laboratories who can get much better salaries outside. But they remain in CSIR because of the challenges and opportunities that we provide.

BCK: Would the rural-oriented R&D programmes continue to be given the same importance as the industry-oriented ones? And also, would efforts be made towards utilization/marketing of the rural-based technologies in a more effective manner?

RAM: Of course, we would do that since our science finally must be used for the good of the people and our brothers in the rural areas cannot ever be forgotten. But see, different CSIR laboratories have different mix of R&D programmes meant for different market segments. NAL, for instance, deals with aerospace research, which is in the so-called high-tech areas. On the other hand, our Palampur laboratory focusses very closely on rural technologies. Basically, there has to be a grand plan where we decide what is that we do for the social good, what is that we do for industry and what is that we do for the advancement of knowledge, etc. So, it is not that we would do only industry-driven research. There will be a proper balance of work between all these, and emphasis will be on excellence.

BCK: With reduced funding by the Government and CSIR being asked to look for alternative sources, how do you plan to solve the problem of resource crunch?

RAM: This situation is prevalent not only in India but all over the world. As a consultant to the World Bank for suggesting reforms in public funded R&D institutions, I have studied this problem globally. All over the world, people are saying that, since the public-funded institutions are intended to serve the productive sector, the productive sector should pay for their services. I fully subscribe to this view and would want our laboratories to earn maximum income from alternative resources. There are several departments, socio-economic ministries and international agencies which have a lot of funds but which have not been tapped by us. So, as a major step, we would be setting up a 'strategic group' which will look at the present funding situation and work out strategies on tapping alternative resources.

BCK: What would be your target for self-sufficiency?

RAM: We would aim at attaining 50% self-sufficiency by the year 2000. That is a big ambition — but we must set ourselves high goals.

BCK: That is in spite of increase in expenditure owing to inflation, increase in salaries, etc., and giving incentives to scientists?

RAM: This is our target and we would do our level best to meet it. And then, we are not going to give incentives to scientists from the laboratory money. It is a share of the profit that a scientist makes. See, profit is the difference between the price and the cost. The price should keep on increasing by offering better knowledge-based high value-added services and cost should keep on reducing by doing things more and more efficiently. So, incentive would depend on your ability to make profit. If you increase your profit you will get more. It is all performance based.

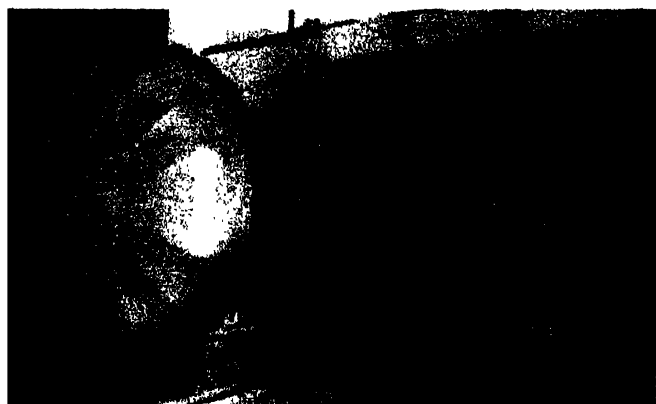
BCK: Finally, what is your vision about yourself?

RAM: As I said earlier, my vision is to be the Chief Executive Officer of CSIR Incorporated — I want to see this great organization to really develop a corporate culture and have corporate goals — and I want to do my bit to make this happen. □

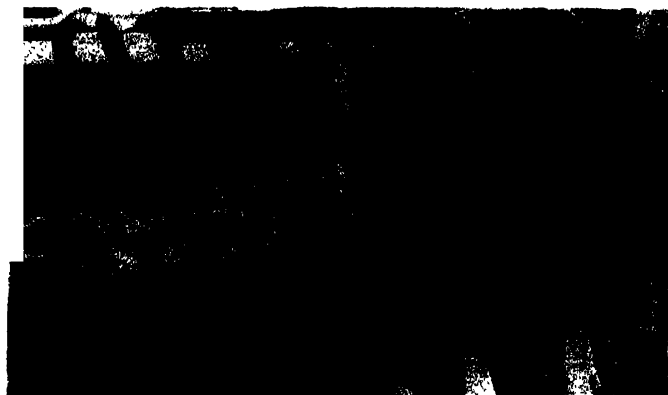
National Aerospace Laboratories, Bangalore

R & D Highlights : 1994-95

DURING 1994-95, the National Aerospace Laboratories (NAL), Bangalore, put its sophisticated computer-controlled 3m x 7m autoclave into regular operation for fabricating CFC spars for the carbon fibre wing, fin and rudder of Light Combat Aircraft (LCA). The design, development and commissioning of this autoclave is being hailed as a remarkable achievement of NAL. The work on design and development of the 4m x 8m autoclave, undertaken for Hindustan Aeronautics Limited (HAL), registered a significant progress.



The state-of-the art computer controlled 3m x 7m autoclave at National Aerospace Laboratories which was commissioned in June 1994



Light Combat Aircraft carbon fibre wing spars. Sixty of the 74 wing spars were fabricated at National Aerospace Laboratories

The detailed drawings for the fabrication of the autoclave vessel have been completed by the Bharat Heavy Electricals Ltd (BHEL) who are the sub-contractors of NAL on this project. The fabrication work has also started. This autoclave, when completed, will be the most sophisticated and the only one of its kind in the country.

The carbon fibre wing development, undertaken by a National Team formed under the leadership of NAL, also registered a significant progress. All the parts of the wings have been mounted on the assembly jig and the skins are also ready for assembly.

The wing would be ready soon for coupling with the fuselage.

The Composite Structures Group made a significant contribution by fabricating the 60 CFC spars required for the first set of wings in time. The Group has also taken responsibility to fabricate the landing gear doors and the wing fuselage fairings.

The fabrication of co-cured carbon fibre composite fin for LCA also registered a significant progress. The fin would also be ready for integration with the fuselage soon. The

carbon fibre rudder for LCA has been fabricated and is ready for mounting on the rest of the LCA airframe.

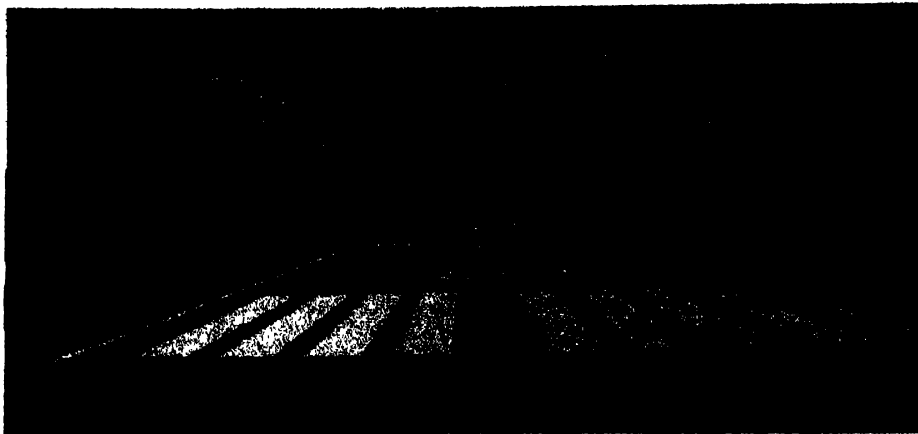
Scientists of the Flight Mechanics and Control Division have played a key role in the development of fly-by-wire control law for the LCA Technology Demonstrator TD-1, as part of the National Team set up for this task. The base line control law for the TD-1, which almost meets all the requirements for the first flight standards, is now ready.

The real time 'Engineer-in-the-Loop Simulator' (ELS) set up earlier has played a key role as a control law design optimization tool.

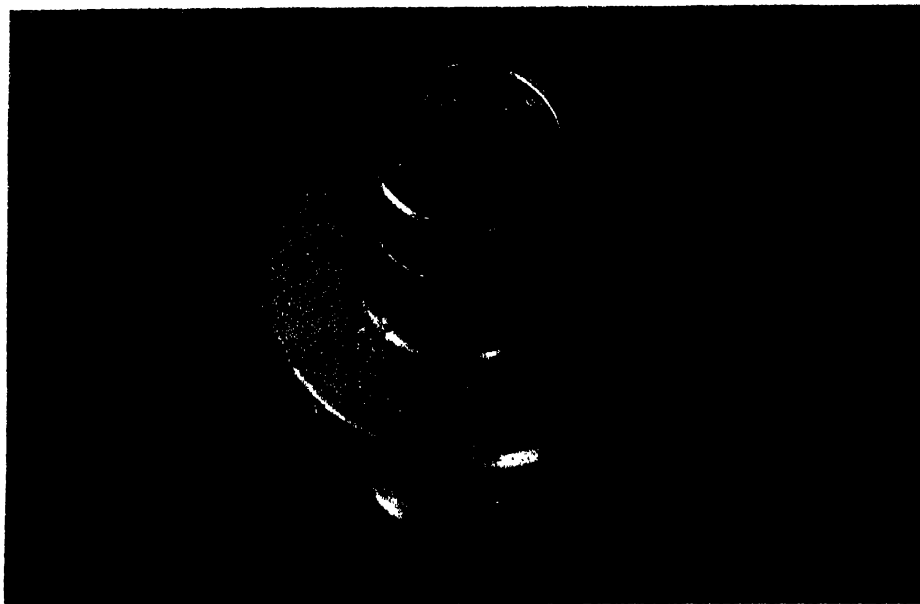
The development of *Saras Duet*, the 14-seater light transport aircraft, also recorded considerable progress. A big industrial house has shown interest in the project. A presentation was made to the Board of Directors of this industrial house



Aeroelastic model of GSLV



Visual display on the monitor of the engineer-in-the-loop flight simulator



Foil bearings designed and developed at NAL, Bangalore, for textile industry

which has a strong ambition to enter into civil aviation market in a big way. A perspective corporate plan in civil aviation has been prepared at their request. A detailed presentation on the development of *Saras-Duet* and its current development status was presented to the Chairman and Management Council members of HAL. HAL now appears to be seriously considering participation in the programme. The detail design of the wing, empennage and the engine mount structure has been taken up. The *Hansa-3* development programme also registered a significant pro-

gress during the year. Several meetings have been held with the officers from DGCA to discuss the various aspects of certification, and a number of test programmes for qualifying design allowables and other assumptions made in the design were taken up. Post-curing parameters have been determined to push up the glass transition temperature as required by the certification authorities. All the moulds required for the fabrication of different parts of *Hansa* were made for fabrication of the test airframe. The design of the wing root joint went through a number

of modifications as a result of inputs received during design reviews. Now the design is finalized. *Hansa-3* is likely to have its first flight before the end of 1995-96.

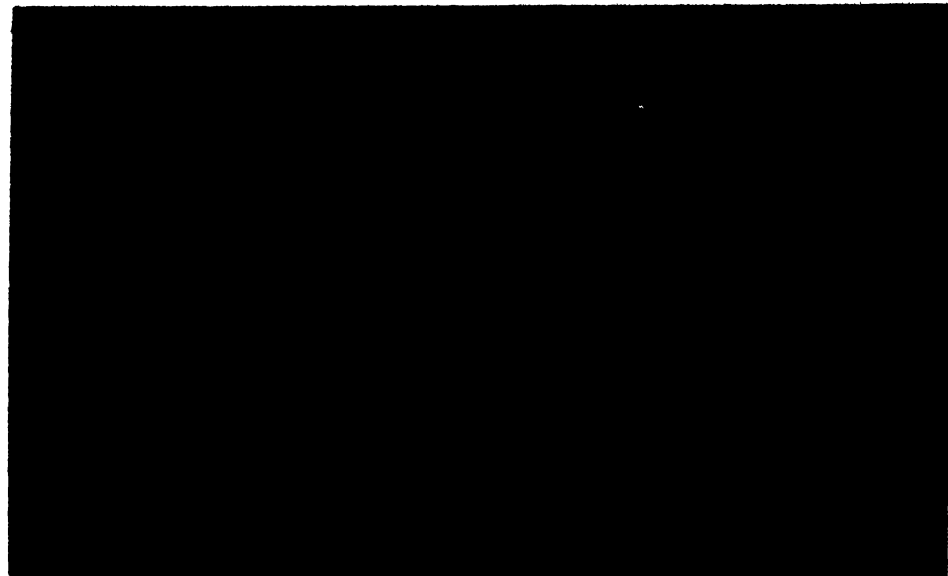
In order to give due importance to the projects on development of the two aircraft, which require considerable involvement from all divisions, a Centre for Civil Aircraft Design and Development (C-CADD) has been established. Under a TIFAC-sponsored project, NAL produced three reports containing a survey of opportunities for Indian aviation products and services, and several copies of these reports have been sold to industries and R&D organizations in the country and abroad.

An aeroelastic model of GSVL was designed and fabricated using GFRP and other materials. The design and fabrication of the equivalent plate aeroelastic model of the LCA wing was also completed. This model was made completely out of CFRP. The dynamic characteristics of the model wing matched well with those estimated for the actual wing. These models are scheduled to be tested in the 1.2 m trisonic wind tunnel shortly.

The 1.2m trisonic wind tunnel has completed a total of 20,000 blowdowns; of these 1270 blowdowns were completed during the year. Various tests in the tunnel provided valuable data for different national aerospace programmes. Notable among these tests are the studies carried out on combat aircraft models to investigate the effects of failure of leading edge slats and studies on PSLV models to assess effects of protrusion and aerodynamic characteristics. The calibration exercise on the 1.5 m low-speed wind tunnel was continued.

During the year, the CSIR Centre for Mathematical Modelling and Simulation (C-MMACS) initiated an important programme modelling of crustal strain in the Indian crust using modern satellite-based Global Positioning System (GPS) receivers. The studies made in the southern peninsula have demonstrated capability of the approach to detect strain rates as low as 0.01 micro strains per year thereby offering a measurable approach to delineating areas of potential seismic hazard. This is a significant achievement in background of the destructive Latur earthquake. The CPU of the C-MMACS Convex supercomputer has logged 11,600 hours since its commissioning early last year indicating the wide ranging demand for modelling and simulation. A study was undertaken to define the initial evolutionary features of cyclone in the context of the cyclone-prone Bay of Bengal. This study has opened up the possibility of developing viable mathematical models for early warning of cyclones. C-MMACS continues to be actively involved in modelling and simulation problems relating to drug design, pollution, etc.

Serious efforts were made this year in globalization and finding new avenues for international collaboration. A delegation from NAL visited, in June 1994, the aeronautical establishments in China at the invitation of Prof Zhang Yanzhang, President of the Chinese Aeronautical Establishment (CAE), Beijing. A delegation from China headed by Prof. Zhang Yanzhang visited NAL during August 1994 to see the activities of NAL and to identify areas for mutually beneficial collaboration. A protocol on collaboration in aerospace R&D between NAL and CAE was signed. A three-member delegation from Boeing, headed by Mr Robert Spitzer, Vice President, Engineering, visited NAL to explore avenues which can lead to mutually



Grid for turbine cascade computation

beneficial projects and to establish a long-term relationship with NAL. The delegation invited R&D proposals which Boeing could consider and support depending on its interest and usefulness to programmes at Boeing. Fifteen specific R&D proposals in various areas were discussed with Boeing. Interest was evinced in twelve proposals. Boeing has sponsored a programme on lug damage tolerance studies at a cost of \$ 110,000. Recently, they have also sponsored a programme on relaminarization, the first phase of which is supported at a cost of \$ 20,000.

Visits to DLR laboratories in order to strengthen relationships with the new directors of laboratories resulted in identification of new areas for collaboration between NAL and DLR. Smart structures is an area which has been identified for collaboration between Institute of Structural Mechanics, DLR, Braunschweig, and Structures Division, NAL. In order to strengthen NAL's interaction with industries, the Confederation of Indian Industries (CII) was invited to

bring a delegation of leading industrialists of NAL so that they can have a first hand exposure to NAL's technologies and capabilities. In response, CII sent a delegation of representatives from over a dozen leading industrial establishments during August 1994. Presentations were made on R&D activities and technologies developed. The delegation was also shown the various R&D facilities at NAL. As an outcome of this, some work for a private industry has already begun.

A total of Rs 850.8 million were available at NAL during 1994-95, an increase of 24% over the previous years. This amount comprised: CSIR grant—Rs 237.7 million, from external sources—Rs 487.4 million, NAL's own funds—Rs 62.9 million, and miscellaneous—Rs 62.8 million.

□

Thermal structure and flow pattern in western Indian Ocean

THE upper layer seasonal thermal structure (0-760 m) and the inferred zonal flow path along Bombay-Mauritius XBT track-line were studied by scientists of National Institute of Oceanography, Goa, (NIO), utilizing the data collected during 1992-94 under TOGA-XBT programme. The flow pattern reveals the presence of undercurrent centred at 1°S, 62.5°E during March and its absence during May-September. During May the eastward flowing Indian Monsoon Current (IMC) occupies the upper 300 m column between equator and 5°S with a convergence zone at 3°S, 65°E. With the onset of summer monsoon the development of IMC towards north of equator and reversal of flow towards coast at sub-surface (below 100 m) depths are evident during June-July. This flow regime gives rise to strengthened thermocline around 100 m at the equator and 5°S with a convergence of warm water above and upwelling of sub-surface waters due to equatorial divergence below 100 m. However, during July a fall in temperature of 1°C in the upper 100 m depth between 2°N and 2°S is noticed followed by intensification of the IMC between 5°N and equator. This intense surface layer cooling is primarily due to the upwelled cold waters off the south-western coast of India and southern Sri Lanka and partly due to the influence of equatorial divergence. During September the revival of thermal field close to that of pre-monsoon (May) condi-

New NIO Findings

tion is observed between 64° and 68°E giving rise to reversal flow regime compared to that of monsoon months, with surface westward flows and sub-surface eastward flows. Thus spreading of thermocline occurred during September. The seasonal shift of the eastward flowing Southern Equatorial Current (SEC) is also identified, with its location at 9.5°S, 70°E during February, 5°S, 74°E in May and 8°S, 57°E during September.

Flora and associated biota around Marine Park, Gulf of Kuchchh

INVESTIGATIONS on flora and associated biota around the area under National Marine Park, Gulf of Kuchchh, Gujarat, indicated that it consists of about 50 species of seaweeds and seagrasses and 22 species of mangroves mainly restricted to reef slope (upto 3-4 m) and reef flats. Dominating species in reef flat were *Digenia simplex*, *Gracilaria corticata*, *G. crassa* and *Hydroclathrus* spp. Seaweed flora was rich quantitatively and qualitatively during March to April. The mud flat algae were dominated by *Enteromorpha*, *Ulva lactuca*, *Polysiphonia*, etc. Mangrove *Avicennia marina* contributed 98%. The Gulf of Kuchchh region, particularly the area under National Marine Park, is the richest in marine biodiversity along the west coast and needs protection as well as further evaluation.

The influence of flyash on mild steel

THE corrosion behaviour of mild steel in concrete containing various proportions of flyash has been studied by potentiodynamic method using a potentiostat (EG&G). The proportion of flyash replacement varied between 0 and 20% with an increment of 5% to cement. A reduction in the corrosion rate was observed in the concrete mix with 20% of flyash replacement. The corrosion rate and polarisation resistance of control specimen and the specimen with 20% flyash was 0.285 mpy, 35.08 KQ-cm² and 0.127 mpy, 83.5 KQ-cm² respectively. This has been attributed to the reduction in porosity of concrete matrix due to the addition of flyash. The addition of this mineral waste was found to be beneficial in reducing corrosion rate of embedded steel in concrete especially for seawater exposure.

Archaeological explorations in Goa waters

MARINE archaeological exploration was undertaken in Goa waters from 7 to 13 November, 1994. A shipwreck at Grande Island was located and documented with underwater still camera. Some of the important antiquities collected include a pulley with Roman character 'USA, 20 TONS TESTED' and one link of anchor chain measuring 40 x 25 cm. The

ship must have belonged to USA and is of World War II period.

Heat Budget in the Bay of Bengal

FROM the mean fields of the heat budget parameters computed in the warm pool over the Bay of Bengal for the post-monsoon season utilizing the data collected onboard RV *Gaveshani* and ORV *Sagar Kanya* for 1983, 84 and 85, the sea surface temperature (SST) is greater than 28°C throughout the Bay. Warm waters of temperature 29 - 30°C were noticed off Sri Lanka. High and negative values of Richardson number indicate convective zones close to 10°N. The distribution of heat exchange (Q_n) suggests that the role of advection is important in the Southern Bay while at the Head of the Bay, air sea fluxes play an important role in the SST variability.

Waves in the Gulf of Kutch during SW monsoon

WAVE studies carried out during June-July 1994, off Navinal, Gulf of Kutch, at a depth of 10 m revealed the predominance of 'seas' over 'swells'. Significant wave height and period (maximum) observed during the period of study were 1.30 m and 7.1 second and respectively. Predominant wave direction was between SSW and W. The E-W orientation of the Gulf

allowed only these waves to enter into the Gulf. A comparison made between 1993 and 1994 wave data indicated that 1994 wave conditions to be relatively higher due to the severity of monsoon. Due to the predominance of 'seas' in 1994, wave periods were lower compared to those in 1993.

Magnetic data off Mahabalipuram shelf

MAGNETIC data along three coast paralld sections (P1 to P3) off Mahabalipuram shelf (30-60 m water depth) revealed short wave length/high amplitude magnetic anomalies with amplitudes of the order of 200-750 nT. Two NW-SE coastal cross trends delineated from this data are located off Polar river and south of Mahabalipuram. Two dimensional modelling of these anomaly sections indicates intense folding in basement beneath the inner shelf between Polar river mouth and Mahabalipuram. The derived models indicate that the Polar river is associated with faulted basements. The folds in the basements are relatively subdued at deeper depths.

Sources of fine-grained sediments on the western continental margin of India

FLUVIALLY derived fine-grained sediments (clay minerals and

amorphous materials) are mainly (90%) deposited in the near shore and continental margins and the rest is transported to the deep sea. Distribution and dispersal of fine-grained sediments on margins depend on hydrodynamic conditions and depositional processes. A knowledge on the fate of these sediments is of scientific interest and useful in understanding the pathways of pollutants (toxic metals and organic materials).

NIO studies on one hundred and fifty six surfacial sediments from the western continental margin of India at depths between 17 and 2000 m for clay mineralogy (2 μ m size fraction of the sediments) indicated three characteristic clay mineral assemblages reflecting three principal sources of sediments (Indus Province, Deccan Trap Province and Gneissic Province). These source sediments are distinct all along the inner shelf but admix on the outer shelf and slope. The Indus derived sediments are transported by a southerly surface current to the outer shelf of Saurashtra and on the continental slope from Saurashtra to Goa and admix with those transported from the hinterland. Bypassing of the fine-grained sediments occur on the carbonate platform due to higher energy conditions. Cross shelf transport processes dominate in the southwestern continental margin between Goa and Cochin. □

IICT Golden Jubilee's concluding ceremony: Prime Minister lauds IICT contributions

ADDRESSING a gathering of distinguished scientists at the concluding ceremony of Golden Jubilee (1944-1994) of the Indian Institute of Chemical Technology, Hyderabad (IICT), on 1 April 1995, the Prime Minister Shri P.V. Narasimha Rao appreciated IICT scientists for their valuable services rendered to the country. He recalled the pre-Independent conditions in India and admired the foresight and vision of the seventh Nizam of the then Hyderabad State in funding the Central Laboratories for Scientific & Industrial Research (CLSIR) in 1944 which came to the CSIR fold in 1956. He also appreciated the services of Dr S. Husain Zaheer in the establishment of the institute and for his pioneering work done as early as in 1951, which included synthesis of methaqualone — the process was implemented even in Europe at that time!

The Prime Minister gave entire credit to Pandit Jawaharlal Nehru for his foresight and commitment to use science and technology for the socio-economic development of the country, which led to the establishment of a chain of national laboratories. He stressed that competition to develop the best technologies was very important, and cautioned that the technologies made available to India by import were not the best. Lashing out at the criticism over India's joining the World Trade Organization (WTO), he said that the country's future rested on technology and its ability to compete with the best in the world.

Shri Narasimha Rao expressed his concern over the rich flora and fauna and abundant medicinal herbs of India, which are yet to be fully exploited by the country. Mentioning about the exploitation of Indian plants he cited the example of 'Ashwagandha' which was taken from India and sold all over the world, including India, as ginseng. He asked the scientists to turn their attention to the natural wealth of the country for its necessary exploitation, and declared that the Government of India had already decided to have a separate Ministry for Indian Medicines which would have nothing to do with the Health Ministry or any other ministry. He hoped that scientists of CSIR and other research organizations would try to have as many patents on plant products as possible. He stressed the need to improve the expertise in utilizing the local resources. He also emphasized the need to establish collaborations with countries in the East and Southeast region. Stating that there was an urgent need to raise the level of research in every field to meet the global competition, he opined that universities, research institutions and industry should come together to overcome their limitations and act in unison to meet national demands and aspirations.

Earlier, the Prime Minister inaugurated a new Golden Jubilee Block consisting of Discovery Laboratory, a Natural Products Laboratory, and Catalysis Laboratory on the IICT Campus.

Welcoming the Prime Minister, Dr A.V. Rama Rao, the then Director of IICT, briefly recapitulated the growth of the institute since its inception in August 1944 as the Central Laboratories for Scientific & Industrial Research (CLSIR), its renaming as Regional Research Laboratory, Hyderabad, in 1956,

and subsequently as Indian Institute of Chemical Technology in 1989, on the recommendations of the CSIR Review Committee, to reflect the focus and direction of its R&D expertise in chemical science and technology.

Reviewing the contributions of the institute since its early days, Dr Rama Rao said that under the able stewardship of Dr S. Husain Zaheer in the 40s and 50s, research in diverse areas of industrial interest was pursued with the basic aim of import substitutions and utilization of regional resources and pilot plant production of certain material for trade and industry. The 60s and 70s witnessed the orientation of R&D towards industrial intermediates, and plants for sodium azide, benzyl chemicals, glyoxal, etc., were set up based on the institute's technologies. In the 70s, the R&D emphasis was on the development of technologies for essential agrochemicals identified for the country. The activity continued and by the 80s nearly 60% of the production of organo-phosphorus pesticides in the country was through the IICT technologies. From the mid 80s, cost-effective and commercially viable knowhow development programme was launched under the sponsorship of Indian drug industry. A number of anti-cancer, anti-bacterial, anti-asthmatic, anti-inflammatory, analgesic, cardiovascular, anti-glaucoma and beta-blocker drugs entered the market, paving the way for indigenous production of various bulk drugs and catalyzing the production of drugs for export by the Indian drug industry.

Dr Rama Rao also mentioned the strengthening of the fundamental research in the institute, which has led to gradual increase in the publication of research results in reputed national and inter-

national journals and in the number of national and international awards coming to IICT scientists. Apart from successful completion of sponsored research for the Indian industry, the institute concluded several contracts with renowned multinationals like Parke-Davis, Abbott Laboratories, FMC Corporation and DuPont for interactive R&D collaborations for the development of new processes/products in the area of drugs and agrochemicals.

Above all, institute's earnings (which were mostly from private parties) rose from a meagre Rs. 2.5 million in 1984-85 to Rs. 45 million in 1993-94, which was nearly one-third of the total earnings of CSIR from industry for that year. In the end, Dr Rama Rao also touched upon the future R&D plans of the institute.

The Union Minister of State for Science and Technology, Shri Bhuvanesh Chaturvedi, observed that India has made rapid strides in R&D in many areas, including life-saving drugs. He complimented IICT for its earnings. Shri Chaturvedi also released a book entitled *50 Eventful Years of IICT*.

Shri Krishan Kant, the Governor of Andhra Pradesh, advocated the need for linking laboratory efforts to industry. Shri N.T. Rama Rao, Chief Minister of Andhra Pradesh, asserted that the country was quite capable of developing technologies on its own to suit its needs. Prof. S.K. Joshi, the then Director General, CSIR; Dr S. Varadarajan, Chairman, IICT Research Council; Dr David S. Weir, Vice President, Global Technology, Agricultural Products (USA); Prof. Bert Frazer-Ried of Duke University, USA; Shri Deshbandhu Gupta, Chairman, Lupin Laboratories; and Prof. M.M. Sharma, UDCT, complimented IICT for its



Seen at the Indian Institute of Chemical Technology Golden Jubilee concluding function (from left): Dr A.V. Rama Rao, the then Director, IICT, Prof S.K. Joshi, the then D.G., CSIR, Shri Krishan Kant, Governor of Andhra Pradesh, Shri P.V. Narasimha Rao, Prime Minister of India, and Shri N.T. Rama Rao, Chief Minister of Andhra Pradesh.



Dr A.V. Rama Rao, the then Director, Indian Institute of Chemical Technology, showing the model of the Discovery Laboratory to the Prime Minister Shri P.V. Narasimha Rao. Shri Krishan Kant, Governor of Andhra Pradesh, is on the extreme left

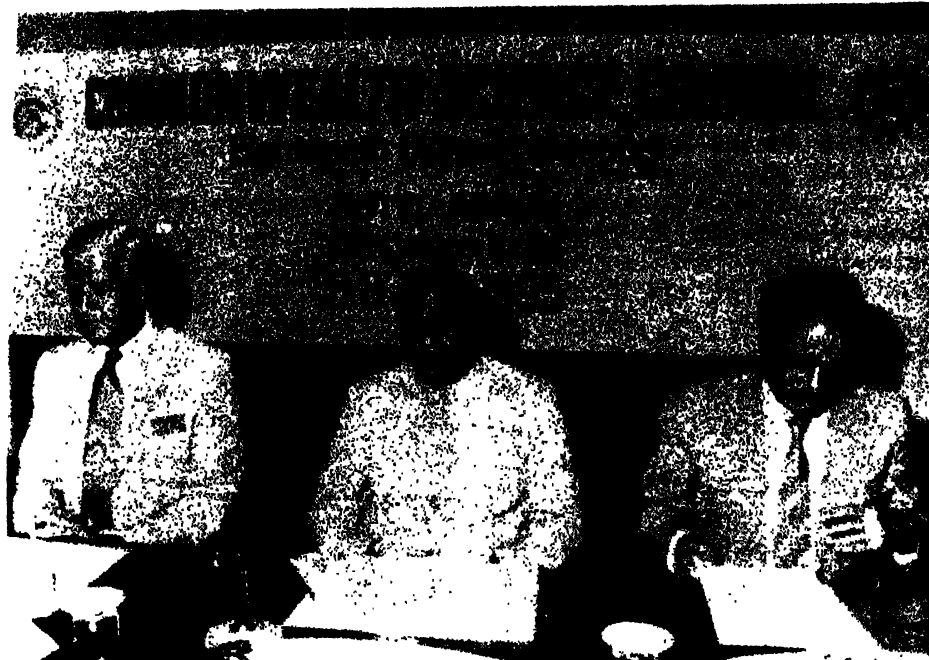
pioneering efforts in R&D. Dr U.T. Bhalerao, Director-Grade Scientist, IICT, proposed a vote of thanks. □

Commonwealth Science Council

THE 18th Biennial Meeting of the Commonwealth Science Council was held for the first time in India on 5 June 1995 at a hotel in Bangalore. Shri Bhuvanesh Chaturvedi, Union Minister of State for Science & Technology, inaugurated the meeting and lit the ceremonial lamp. About 57 delegates and observers from 31 Commonwealth countries attended the 3 day meeting. This meeting was significant because it marked 20 years of existence of the Council. The meeting will, among other things, devise the message for the Commonwealth Heads of Government Meet to be held later this year at Auckland.

The inaugural function opened with a brief welcome speech by Shri Dilip Kumar, Joint Secretary, CSIR, followed by the distribution of bouquets to the dignitaries present on the dais: Shri Bhuvanesh Chaturvedi, Sir Humphrey Maud, Deputy Secretary General, Commonwealth Secretariat, Prof. S.K. Joshi, the then DG, CSIR, who is also Chairman of the CSC, Shri K. Srinivasan, former Foreign Secretary, who is shortly taking over as a Deputy Secretary General of the Commonwealth Secretariat, Dr U O'D Trotz, Secretary, DSC, Ms Judith Johnson, Deputy Secretary, CSC and Dr K.N. Raju, Director, National Aerospace Laboratories.

Prof. Joshi formally welcomed the delegates and observers attending the meeting. Describing the meeting "unique" as it marked 20 years of existence of the CSC Prof. Joshi said that it was an occasion both for celebration and introspection. The meeting, he hoped, would evolve priorities and foster even greater scientific cooperation "in an increasingly interdependent world".



Seen on the dais at the inaugural session of the Eighteenth Biennial Meeting of the Commonwealth Science Council (from left) are: Sir Humphrey Maud, Shri Bhuvanesh Chaturvedi and Prof S.K. Joshi

Sir Humphrey Maud, who began by conveying the greetings of the Commonwealth Secretary-General, noted that the meeting was opening on a significant day in the world calendar as it was also the World Environment Day. Sir Humphrey said that scientists have to be the "stewards and custodians of our fragile environment". Paying a tribute to Indian scientists "who have excelled in their art", Sir Humphrey fondly recalled the occasion when he played a Beethoven Concerto to Homi Bhabha in 1952.

In his brief inaugural speech, Shri Bhuvanesh Chaturvedi said that India has always "recognized the importance of science in the socio-economic development" and that the country's policies "have always been tuned in the direction of S&T for the past five decades". The minister, who described sustainable development to be the "need of the hour", also expressed his happiness that "CSIR is gener-

ating resources in line with the ongoing reforms and has forged effective links with the industry for the benefit of both."

After a brief vote of thanks by Dr K.N. Raju, the delegates and invitees attended a luncheon reception hosted by the minister. □

NAL Foundation Day

THE NAL Foundation Day held on 19 June 1995 was an important date in National Aerospace Laboratories', Bangalore, (NAL), annual calendar. Dr K. Kasturirangan, Chairman, Space Commission and Secretary, Department of Space, delivered the Ninth NAL Foundation Day Lecture on that day. The title of the lecture was: "Future Space Transportation Systems—Role of R&D Institutions".

Dr Kasturirangan began his lecture by a review of the development of rockets through the ages.

He said that the beginnings of rocket technology could be traced to Chinese rockets of the 13th century and "it was realised only much later that the rocket could be a weapon of war". Dr Kasturirangan also showed an unusual photograph of Prof U. R. Rao in a British Museum looking at a Mysore rocket.

The ISRO Chairman then went on to talk about ISRO's early sounding rockets "which started in as peaceful a place as a Church" leading eventually to the SLV3, ASLV, PSLV and GSLV. He describes GSLV as "India's ultimate launch vehicle". He was also candid in discussing the early ASLV failures which nevertheless provided "critical inputs" to India's space programme.

What one found most impressive in the lecture was the extent and quality of ISRO's R&D planning. Dr Kasturirangan presented a veritable blueprint of ISRO's plans and projects for the next 15 years, taking special care to point out areas where NAL could contribute in a very significant way. Another, and equally noteworthy, feature of Dr Kasturirangan's lecture was when he talked of future space technologies and remarked that such and such space technology would be mastered in three or five years. There did not seem to be any doubt in the Chairman's mind that those technologies would eventually be mastered! One was greatly impressed by this dimension of confidence.

The NAL Foundation Day function opened with a moving welcome speech by Dr K.N. Raju, Director, NAL, in which he paid tributes to the remarkable contributions of his predecessors, namely, Dr P. Nilakantan, Dr S.R. Valluri, and Prof. R. Narasimha. The NAL Director also made a touching reference to the late Shri Raj Mahindra and declared NAL's

resolve to make *Saras-Duet* fly "which would be the most fitting tribute to his memory".

The function ended with the distribution of NAL Outstanding Performance Awards by the Chief Guest, the release of the NAL Annual Report 1994-95 by Prof. U.R. Rao and a lucid summing up by Prof. Rao who raised the question whether the future of the space programme lay in "bigger launchers or smaller satellites". Prof. Rao too had no doubts about the success of human endeavours in space and wondered whether the homo sapiens species were more likely to turn into homo spacens! Dr B.R. Somashekar proposed the vote of thanks. □

Workshop

Philosophy of Rural Development

SCIENCE and Technology Entrepreneurship Development Task Force for Pasumpon Muthuramalingam district Rural Science Forum; Central Electrochemical Research Institute (CECRI), Karaikudi; District Science Centre, PMT district; and Swadeshi Science Movement, Karaikudi, organized a workshop on 'Philosophy of Rural Development' in memory of Dr Thavathiru Kundrakudi Adigalar on 11 June 1995 at CECRI. Dr Adigalar, who has devoted his entire life to the upliftment of rural poor, was the brain behind the Kundrakudi pattern of rural development.

In his inaugural address, Dr K.V. Raghavan, Director, Central Leather Research Institute (CLRI), Madras, said that integrated rural development models must be constantly reviewed and modified so that development projects can meet the needs of the rural poor.

'Social causes' were the driving force behind the evolution of development models. But as social values have changed and economy liberalized, the main criterion for any development model now is its economic sustainability.

Another factor to be taken into consideration is the number of employment opportunities that a scheme could generate, since rural families depended on multiple sources of income and all the members of a family have to find employment. A training centre in leather goods, attached to the village planning forum, should therefore not only train the villagers in tanning of leather but should also assist in the development of production and marketing units which will help provide gainful employment to the trainees.

CLRI is already working on a National Leather Technology Mission and is helping leather units to modernize and control pollution in a big way. It is also training people in rural areas in advanced leather technology. Holding of such a training programme in Karaikudi will be very fruitful because of the coordination that exists between the scientists, politicians, NGOs (such as the one founded by Kundrakudi Adigalar) and the population at the grassroots level.

Shri. S.V. Nagappan, President, Chamber of Commerce, Karaikudi, and H.H. Ponnambala Desika Swamigal, new head of the Kundrakudi Mutt, offered felicitations on the occasion. In his address, Prof. G.V. Subba Rao, Director, Central Electrochemical Research Institute (CECRI), said that the modification of the Kundrakudi model to make it more effective was possible with the active involvement of people, government and quasi-government agencies, private industries and planners. Dr K. Balakrishnan, Deputy Director, CECRI, said that the seminars

that help take technology to the rural areas should be held more frequently.

Dr K. Dharmalingam, Member-Secretary, Tamil Nadu State Council for Science and Technology, mentioned the government programme to adopt young students at the middle-school level for popularizing science and technology among them. It is also helping in developing entrepreneurship. Dr P. Subbiah, Chairman, Rural Science Forum, CECRI, welcomed the gathering. Shri P. Sivakumar, IAS, Collector of Pasumpon Mathuramalinga Thevar district, presided over the function. □

Training Course

PC Applications

THE special course on 'Personal Computer Applications' for SC/ST staff members of CSIR labo-

ratories, which National Aerospace Laboratories, Bangalore, (NAL) conducted during 24-28 April 1995, was a successful affair. 28 staff members from 20 CSIR establishments attended the course.

The course was conducted by Shri S.Panchapakesan and his colleagues of the Computer Support and Service Division, NAL. It was special in the sense that it was exclusively for CSIR SC/ST staff members. Dr N.R. Rajagopal, Head, HRDG, CSIR, inaugurated the course. He said, "It is after all my job to maintain and upgrade the reservoir of talent in CSIR and elsewhere". He talked of the new "national consciousness" in computers ("like nicotine, computers are now beginning to get into the human system") and about its mind-boggling applications ("which save us the tedium of looking into a hundred dusty ledgers and which can turn motor cycles into tigers").

Dr R. Srinivasan welcomed the participants advising them to take the course very seriously "as software is now big business". Shri S.Panchapakesan provided a thoughtful overview on the changing role of computers.

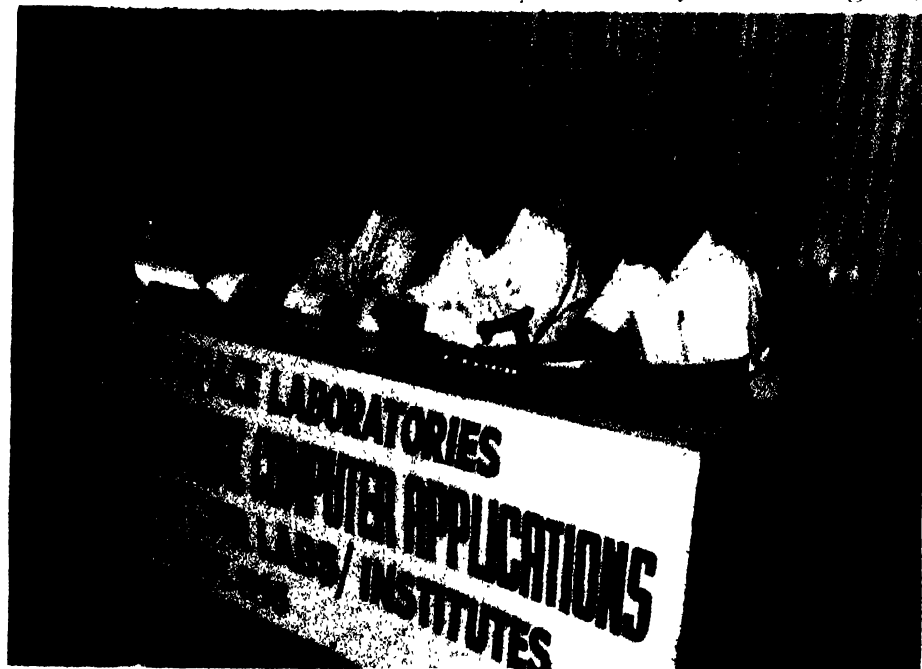
Dr K.N. Raju, Director, NAL, described the different initiatives taken at NAL to encourage and support SC/ST staff members. Shri M.A.Venkataswamy gave the vote of thanks at the end of the inaugural function. At the valedictory function held on 28 April 1995 Shri N. Satyanarayana, Senior COA, Central Leather Research Institute, Madras, explained how computers are essential to give fast inputs in decision-making "especially now that CSIR labs are expected to earn much more".

At the end of the course, there was a demand for more such courses (the second course in this series is likely to be held in September 1995 to coincide with the CSIR Foundation Day celebrations). □

Demonstration Programme

Cashew Apple Processing/Products

IN association with District Industries Centre, Srikakulam, and Central Food Technological Research Institute (CFTRI), Regional Centre, Hyderabad, CSIR-Polytechnology Transfer Centre, Hyderabad, organized a one-day demonstration programme on 'Cashew Apple Processing/Products' on 12 May 1995 at Palasa in Srikakulam district. The programme was sponsored by Commissioner of Industries, Government of Andhra Pradesh. The main objective of the programme was to

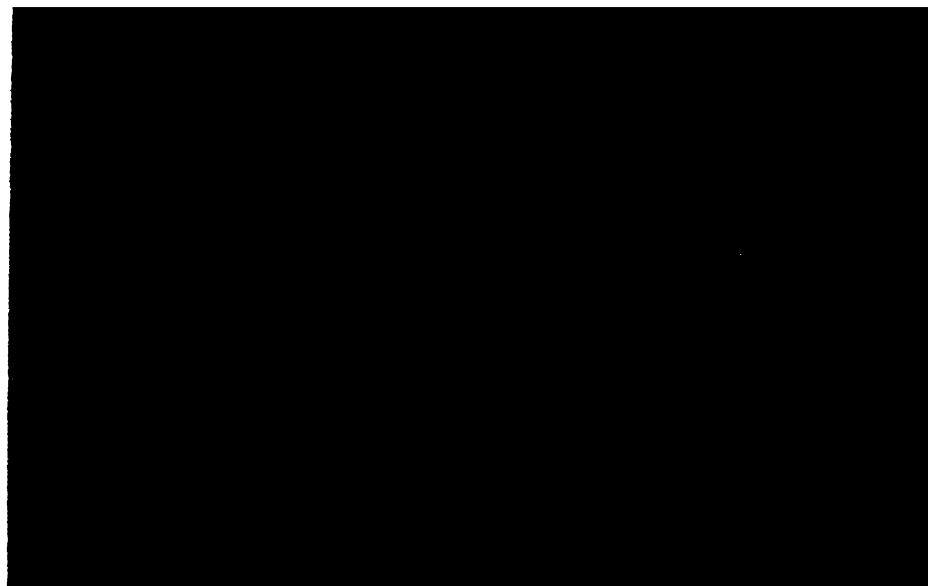


Dr N.R. Rajagopal, Head, HRD Group, CSIR, delivering the inaugural speech at the course on 'Personal Computer Applications' held at the National Aerospace Laboratories, Bangalore

create awareness among the entrepreneurs about the CFTRI technologies based on 'cashew apple' which can produce value-added products. Shri G. Radhakrishnaiah Shetty, Senior Scientist, CFTRI, Mysore, was the Chief Guest at the inaugural function. Shri N. Veerabhadra Rao, General Manager, District Industries Centre, Srikakulam, presided over the function. Shri G.A. Reddy, Project Officer, CSIR-PTC, Hyderabad, welcomed the participants and spoke about the CSIR and PTC activities for the development of industries in rural areas and discussed the practical demonstration programme in detail. Dr D.G. Rao, Scientist and Head, CFTRI Regional Centre, Hyderabad, discussed the food industries in general and cashew apple-based products in particular to the participants. Shri N. C. Harshavardhan, Scientist, PTC, proposed a vote of thanks. About 70 prospective entrepreneurs, District officials and representatives of Government agencies participated in the programme.

While inaugurating the programme, Shri Shetty appreciated the efforts of the organizers in conducting such type of demonstration programmes for the benefit of prospective rural entrepreneurs, which will help them in setting up industries based on cashew apple. Shri N. Veerabhadra Rao called upon the industrialists, prospective entrepreneurs and representatives of various institutions to utilize the simple and innovative CFTRI techniques/technologies to produce value-added products.

The inaugural session was followed by a practical demonstration of processing of cashew apple fruit into the following value-added products, i.e., cashew apple jam, cashew apple juice, cashew apple chutney, cashew apple pickles,



A demonstration of cashew apple processing

cashew apple juice blended with lime, cashew apple juice blended with pineapple. □

Doctorate

A.K. Suryavanshi

SHRI A.K. Suryavanshi of National Institute of Oceanography, Goa was awarded Ph.D by the University of Manchester, Institute of Science and Technology (UMIST), Manchester, U.K. for his thesis "Chloride induced corrosion of steel in concrete" under the guidance of Dr. J.D. Scantlebury, Senior Lecturer, Corrosion and Protection Centre, UMIST, Manchester. □

Honours and Awards

R.N. Iyengar

PROF. R.N. Iyengar, Director, Central Building Research Institute, Roorkee, was appointed the Distinguished Schmidt Visiting Professor

at the Florida Atlantic University, Boca Raton, USA, from 19 to 30 June, 1995. During this period he gave a series of lectures on the research done by him and his group on stochastic and non-linear engineering dynamics. He also initiated suitable collaborative programme with his counterparts in USA. He is the first Indian to be honoured with this distinction.

Padma Madhuranath

MS Padma Madhuranath, Scientist, Flight Mechanics and Control Division, National Aerospace Laboratories, Bangalore, has become a Fellow of the Institution of Electrical Engineers, U.K., with effect from 28 November 1994.

S.R. Rao

DR S.R. Rao, renowned archaeologist and advisor, Marine Archaeological Centre, National Institute of Oceanography, Goa, received the 1994 Award of the Gupta Foundation at Eluru, Andhra Pradesh, at a function

CSIR Enters New Era of Super-computing

THE Parallel - vector Convex C 3820 Super Computer at CSIR Centre for Mathematical Modelling and Computer Simulation (C-MMACS), Bangalore, has successfully crossed a record 10,000 hours of CPU time. This supercomputer has been extensively used by leading institutes, including high profile laboratories of the Council of Scientific & Industrial Research (CSIR) since it was commissioned last year. Scientists at the National Aerospace Laboratories, Bangalore, have developed it for aerodynamical simulations for new aircraft. Likewise, molecular modelling for design of new drugs has been carried out by scientists of Indian Institute of Chemical Technology, Hyderabad, using the supercomputer.

A noteworthy emerging trend is the use of this high performance computing system by remote users through data circuits. This trend is expected to grow exponentially as such usage provides a viable means of drastically reducing time and cutting down costs of development of complex products.

Soon after the 10,000 CPU hours milestone was crossed, Dr K.S. Yajnik, Head, C-MMACS, expressed satisfaction that CSIR scientists have entered a new era of high performance computing. He said, "A high degree of utilization of the supercomputer at C-MMACS in its first year of operation points, in my opinion, to a considerable demand for high performance computing in the Indian scientific community. It also indicates the popularity of this parallel-vector supercomputer with its powerful and yet user-friendly systems software". □

New Publication

Latur Earthquake

CONSIDERING the enormous interest the 30th September 1994 Latur earthquake has generated, the Geological Society of India, Bangalore, has brought out a special book (Memoir 35, 1994) entitled *Latur Earthquake* which is edited by Dr. H.K. Gupta, Director, National Geophysical Research Institute (NGRI), Hyderabad. This 149 + XIII page book contains eleven original contributions by NGRI scientists covering various research activities carried out by the institute immediately after the earthquake. These well illustrated articles bring into focus the multidisciplinary work carried out by the institute in Latur, Maharashtra. A very useful reference guide for future research on the stable continental region earthquakes. □

organized by the Foundation. Dr Rao was honoured with this award for his outstanding contributions in archaeology and his worldwide movement for the preservation of the underwater cultural heritage of man.

R.M.V.G.K. Rao

DR R.M.V.G.K. Rao, Head, FRP Pilot Plant, Materials Science Division, National Aerospace Labo-



ratories, Bangalore, is the winner of the 1993 VASVIK Award for Materials Science and Technology. The award carries Rs 25,000, a gold medal and a citation.

S.W.A. Naqvi

DR. S.W.A. Naqvi of National Institute of Oceanography, Goa, has been selected a member of the Group of Experts for the Evaluation of JGOFF by the International Council of Scientific Unions.

R. Srinivasan

DR R. Srinivasan, Head, Computer Support and Services, National Aerospace Laboratories, Bangalore, has been elected Vice-President of the Computer Society of India. He is the first CSIR scientist to achieve this distinction. □

Printed and Published by Dr G P Phondke, Director, Publications & Information Directorate (PID), Dr K S Krishnan Marg, New Delhi - 110 012
Printed at PID Printing Unit

Editors : Dr B.C. Kashyap, Dilip M. Saini and Madhu Sahni

Production : Kanchal Kishore

Annual Subscription : Rs. 60
Single Copy: Rs. 3.00

Phone: 5786301

Gram: PUBLIFORM

Telex: 031-77271

E-mail: pid@sinetd.ernet.in.

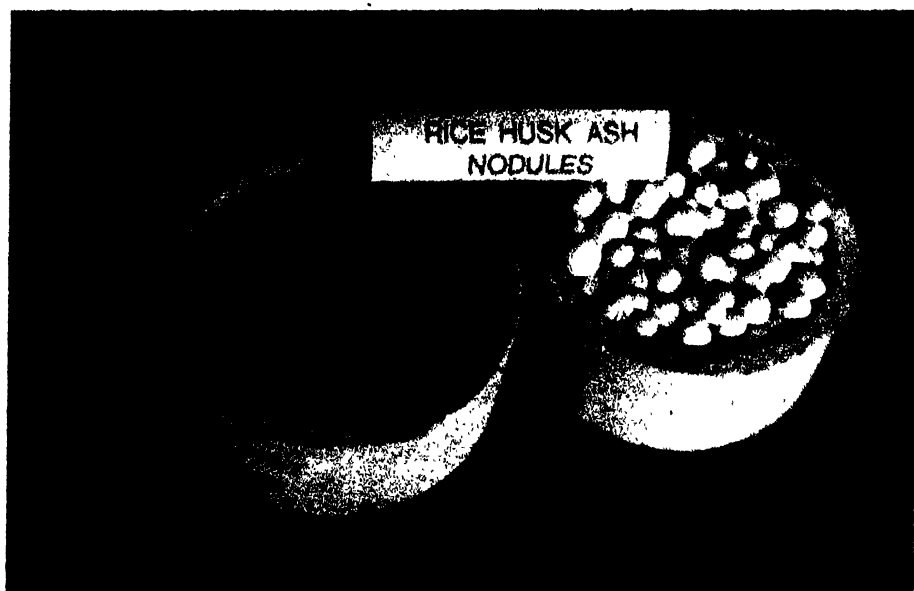
Fax. 5787062

RN 4512/57

CSIR

NEWS

VOL 45 NO 16 30 AUGUST 1995



IN THIS ISSUE

Central Glass & Ceramic Research Institute, Calcutta	
R & D Highlights : 1994 - 95	242
A single test-tube test for detecting pollution	245
Column flotation technology	246
Anti-corrosion technologies — Demonstration with product exhibition	250
A new Herbarium at RRL-Jammu	255
Prof T. Viswanathan elected President, FID/CAO	256

Rice husk nodules for use as insulation of ladles in steel plants and also for insulating self-flow castable manufacture (*Top*). Abrasion-resistant tiles for polishing stones and grinding wheels from beach sand garnet (*Bottom*). Both developed at Central Glass & Ceramic Research Institute, Calcutta. On page 242 appears the R&D highlights of the institute

Central Glass & Ceramic Research Institute, Calcutta

R & D Highlights : 1994-95

DURING the year under consideration, Central Glass & Ceramic Research Institute (CGCRI) Calcutta, made significant R&D contributions in several fields such as optical materials, engineering of ceramics, glass-ceramic coatings, electroceramic and refractory materials, of which some are highlighted below. During the period, the Institute also interacted with several industries for the transfer of its technologies. Some success has been met in this direction. Besides, the Regional Centres of the institute have been quite active and have achieved several R&D goals. The Extra Budgetary Resources of the institute during the period were Rs 15.91 million.

Optical materials

Communication fibre. Fibres doped with minor additives were prepared and later studied for their radiation response during and following gamma irradiation at room temperature. The fibres were found to be highly sensitive to radiation and useful for dosimeter applications.

The process for incorporation of controlled amounts of rare earth oxides in the core glass of the fibres was standardized for fibre amplifier application. Fibres prepared were found to have refractive index profile, numerical aperture and geometry close to the desired limits.

The process parameters for the development of polarization maintaining (PM) fibres were thoroughly studied. Results achieved in the initial experiments were quite satisfactory.

Phosphate laser glass. Melting and refining parameters of Nd-doped phosphate laser glass (10 kg) were standardized in the

bench-scale plant. A technique has been developed to dehydrate the glass and reduce the absorption coefficient due to OH within 10 cm^{-1} . A few processed rods had been sent to Bhabha Atomic Research Centre, Bombay, and Centre for Advanced Technology, Indore, for performance evaluation.

RPL glass. A contract proposal has been signed with Defence Laboratory, Jodhpur (DLJ), for upscaling the process technology for RPL glass melting and for supply of RPL glass detector. A separate contract has also been signed with Bharat Electricals Limited, Talaja, for transfer of RPL glass melting technology. Some pieces of RPL glass detector has already been supplied to DLJ as per the commitment.

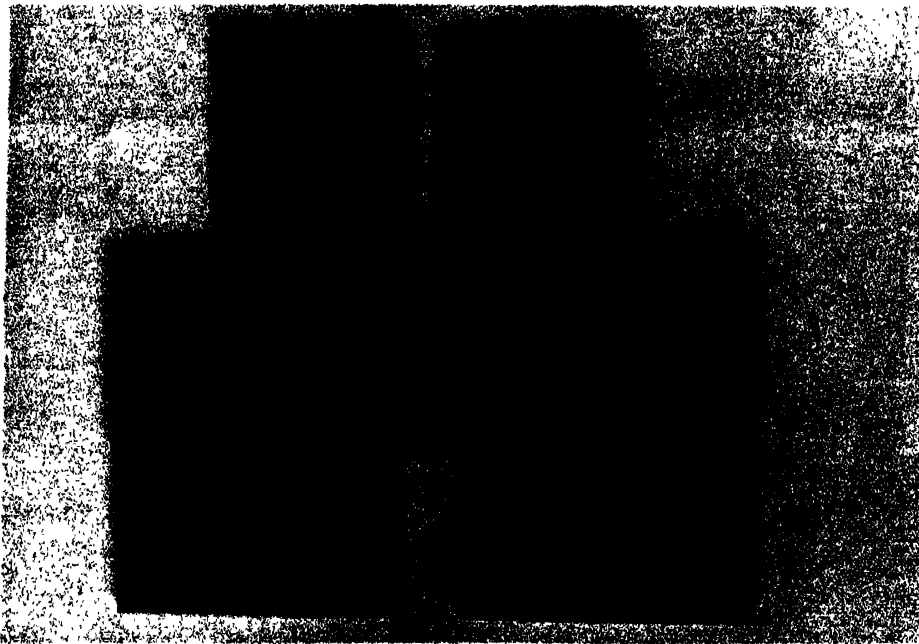
A new method that uses electron paramagnetic resonance of an incorporated paramagnetic transition metal ion has also been devel-

oped for determining the degree of crosslinking in the network structure of an aluminium-containing phosphate glass.

Silica glass. Silica glass developed at Sol-gel laboratory in 1993 showed 40-45% transmission at 200 nm for 3.0 mm thick sample. The process has been modified in 1994 which has led to glasses with better UV transmission properties. The current glasses showed 75-80% transmission at 200 nm for 3.0 mm thick sample. This gives the present glasses better applicability in the field of UV optics.

Engineering ceramics

Sol-gel derived ZrO_2 .20 wt% Y_2O_3 powders in the form of microspheres were developed for the preparation of plasma-sprayed thermal barrier coatings on metal substrates. Coatings prepared at Defense Materials Research Laboratory (DMRL), Hyderabad, using



Synthetic granitic tiles from beach garnet developed at CGCRI, Calcutta

these powders showed that their performance was as good as those prepared from the best quality imported powders used as reference. Upscaling of the process is now under active consideration of INDAL, the sponsor of the project.

Under the best conditions, ZrO_2 fibres stabilized with some of the rare earth ions, e.g., Nd^{3+} , Sm^{3+} , Gd^{3+} and Dy^{3+} , showed a high value of tensile strength, i.e., 1.5-2.0 GPa. This value is comparable to that of the best results obtained internationally for the sol-gel derived doped ZrO_2 fibres.

Glass-ceramic coatings

High improvement in the corrosion resistance properties of blue glass coating required in glass-lined equipment has been achieved.

Process technology for coating mild steel reactors (40 litres) has been standardized in the plant of M/s. Vani Fab Engineering Pvt. Ltd, Hyderabad. Technology transfer formalities are in process.

Electroceramics

PZT powder has been synthesized by an auto combustion technique using solid titania as one of the starting materials in place of hazardous titanium tetrachloride.

The autocombustion technique has also been successfully adopted to prepare submicron powders of Ca-substituted lanthanum chromite, a bonding material for SOFC, which can be sintered at a relatively low temperature. The technique of electrophoretic deposition has been successfully extended to prepare YSZ electrolyte layers on either lanthanum manganite cathode or Ni-YSZ anode.

A low-cost electronic moisture meter has been developed. It is ready for supply to different refractory industries. A prototype electronic LPG gas alarm has also been

fabricated based on a very low cost ceramic thin film type sensor developed at the institute.

Refractory materials

Under the joint collaborative programme with Tata Refractories Limited a project was undertaken (sponsored by CIGI, Firozabad) for the manufacture of 200 litres low cement castables based ceramic pot for glass melting for Firozabad Glass Industries. Seven such pots have already been fabricated and are under trial at Firozabad.

Under the above programme, 12.5 litres capacity low cement castable based pot for continuous melting of radiation-shielding glass at the institute was also manufactured at Tata Refractories Limited. Four such pots with stirrers have been delivered to the institute and the same crucibles are being tried for melting the aforementioned glass.

Under the joint programme among CGCRI, DMRL and IREL, sponsored by Department of Science & Technology (DST), New Delhi, the development of zirconia for high temperature applications has progressed considerably. A few atomizer nozzles based on Mg-PSZ material have been successfully fabricated. Both imported zirconia powder as well as indigenous powder have been used. Trial has also been conducted at DMRL, Hyderabad, for pouring special alloy steel at 1630°C. The results are encouraging. It will soon be possible to manufacture Insert nozzle for continuous casting of steel.

Rice husk ash nodule technology has been developed by the in-



Radiophotoluminescent (RPL) glass developed at CGCRI, Calcutta



Glass-ceramic coatings developed at CGCRI, Calcutta, which are applied on various types of components

stitute and the process has been transferred to M/s. Rescon (India) Pvt. Ltd, Calcutta, for commercialization in March 1995. This product will be used as insulation over steel ladles for castable manufacture.

Under the sponsorship of IRMA, technologies for the preparation of synthetic mullite from sillimanite beach sand and of zirconomullite from zircon sand and alumina have been developed. The laboratory scale work has been completed. Plant trial is in progress at Carborundum Universal, Madras, and VRW Industries, Madras.

Technology utilization

During this period, concerted efforts have been made to transfer the tech-

CGCRI Products/Processes Available for Commercialization

1. Optical glass.
2. Optical communication fibre (multimode).
3. Glass electrodes for pH, pNa and pK measurements.
4. Antiglare coatings on ophthalmic lenses.
5. Glass colours/enamels.
6. Staining composition of glass.
7. Special lead-free and low-lead enamels.
8. Corrosion and abrasion resistant glass-ceramic tile from basalt.
9. Cordierite glass-ceramic materials for industrial and engineering applications.
10. Alumina ceramics for electrical, electronic and other engineering uses.
11. Water filter candle.
12. High strength plaster of Paris.
13. Cordierite saggar.
14. Matt glazed tiles for flooring and facing.
15. Ceramic colours.
16. Glazed wall tiles from common clay.
17. Hollow building blocks.
18. High alumina cements.
19. High alumina aggregate.
20. Sintered alumina products (97-99.7% Al_2O_3).
21. Low moisture castable.
22. High alumina bricks from sillimanite beach sand.
23. High density dolomite sinters.
24. High performance kiln car deck slabs for pottery industry.
25. Design of energy efficient furnaces.
26. Heat wheel.
27. Glass reinforced gypsum (GRD).
28. Rice husk ash insulating bricks.
29. Sodium silicate from rice husk ash.
30. Thermal conductivity tester.

For more details, write to: The Director, CGCRI, P.O. Jadavpur University, Calcutta-700 032. □

nologies developed at the institute to industries. Four processes have been released to industries and few more technologies are expected to be transferred shortly.

As many as four patents have been filed during this period and another nine are in the filing stage. One patent on "Copper activated thermoluminescence dosimeter and method" has been filed in USA. Other patents filed during 1994-95 are: (i) An improved hip joint prosthesis; (ii) An improved process for the synthesis of hydroxyapatite powder useful for biomedical applications;

(iii) A process for the preparation of a copper containing glassy material useful as an U.V. actionometer; and (iv) An improved process for selective and quantitative chemical extraction of alkaline earth oxide phased in ceramic material.

Regional centres

CGCRI Naroda Centre. It is for the first time that a very high quality superwhite and highly translucent bone china were developed at CGCRI, Naroda Centre, utilizing exclusively the china clays avail-

able in Gujarat. Whiteness and translucency properties of the developed body were compared with those of the products made by the established manufacturers in the country. The body developed at the centre was found superior. The technology developed was also transferred to the interested parties through a training-cum-demonstration programme.

The most significant achievement made during the period was the development of velvet finish matt textured fast-fire glaze containing 30 wt% fritted components only alongwith 70 wt% non-fritted components. Such glazes are cheap, more resistant to scratching and crazing, and offer greater economy apart from elegant look and superior finish. The glazes were found suitable under the fast-firing schedules: 12 to 16 hours to cool in shuttle kiln instead of the traditional schedule of 24 to 36 hours, and about 1 hour or even less in Roller kiln.

The technology developed was transferred to M/s. Madhusudan Tiles, Kadi, Gujarat, through a training-cum-demonstration programme conducted at Naroda centre. Cookerywares were also developed at this centre by utilizing 20-25% flyash.

CGCRI Khurja Centre. Under MNES programme, Dhankar village at U.P. was adopted for the trials of a low cost thermal efficient (40%) chulha developed at Khurja centre. Two major industries on bone china, viz., M/s. Pelican Ceramic Industries and M/s Gulraj Industries, were also established due to the training imparted to Khurja potters. □

R & D Flashes

A single test-tube test for detecting pollution

UNICEF estimates that about 15 million children below the age of 5 die in the developing countries every year. The absence of safe water and sanitation plays a major part in this tragedy. If everyone had access to safe drinking water and sanitation, infant mortality could be cut by as much as 50% worldwide. According to the World Health Organization (WHO), approximately 80% of all sickness and disease can be attributed to inadequate water and sanitation.

Water-borne infections are the most common cause of infectious diseases in the developing countries often resulting from a faulty water supply system. The conventional assay used in bacteriological quality testing of water is the enumeration of the most probable number (MPN) of coliforms per 100 ml of water. This test needs the service of qualified technicians, lab facilities and takes 72 hours to give the results. There is thus a need for a simple and reliable field test for use by public health workers in

rural and urban community. National Environmental Engineering Research Institute, Madras Centre, has formulated and developed a simple strip impregnated medium (SIM). If SIM planted in a test tube shows multiple reactions, such as, blackening of medium and formation of red ring, the sample is contaminated. SIM becomes handy for field evaluation of contaminated water supply due the fact that the medium is in the form of dry material and is easy to transport. SIM has been rigorously tested for its efficiency with varying bacterial loads by examining 450 water samples from different sources. The performance of this test was also compared with conventional standard MPN tests in public health laboratories of repute in Madras.

Aliquots of 1 ml of concentrated medium (10 x) were absorbed into good quality pads of 47 mm diameter which were placed in the glass test tube of size 150 x 25 mm with cotton plugs, then sterilized and dried at 50°C under aseptic conditions. When the contents of the tube turned black within 12 to 18 hours, with red ring on addition of kovac's, the screened water was graded as unfit for human consumption.

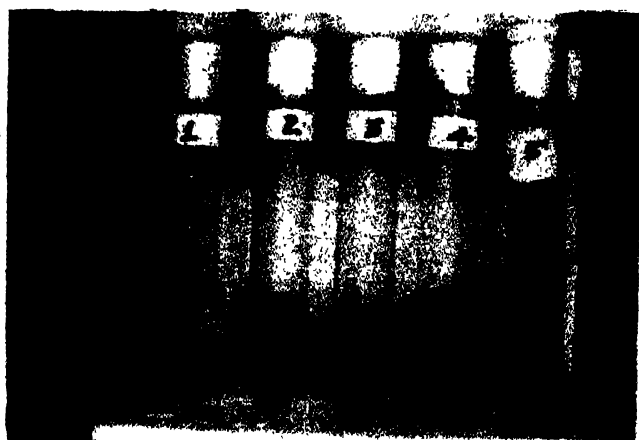
The comprehensive field investigation conducted during the gastro-enteritis epidemic in Madras in the pre-monsoon season in 1992 and 1993 has revealed that the presence of coliform in drinking water is associated with hydrogen sulphide-producing organisms.

Battery Newsletter

CENTRAL Electrochemical Research Institute's (CECRI) Madras Centre is publishing *Battery Newsletter (BNL)*, a bimonthly for the last three years. At the request of industrial and other subscribers and to serve all persons interested in battery science developments, the subscription has been reduced from Rs.500/- to Rs.250/- only per annum from 1 January 1995 onwards.

The *Battery Newsletter* covers various areas such as important developments in the battery industry, primary batteries, fuel cells, rechargeable batteries, battery materials, alternate sources of energy, generalia and products and services. Some issues also contain interviews with top executives working in the field of battery industries and reports on developments concerning battery science in important industries.

Further particulars and subscription form can be had from the Publication Manager, CECRI Madras Centre, CSIR Complex, Taramani, Madras-600 113. □



Changes in S.I.M. on incubation at room temperature with (i) sterile distilled water (control marked 1); (ii) drinking water samples (others marked from 2 to 5) showing positive reaction of varying intensity

The SIM performs two reactions in one single test tube. The test is simple, rapid and inexpensive for the screening of drinking water for fecal pollution. It is based on the principles of biochemical reactions of indole and hydrogen sulphide production without the need for resuscitation or confirmatory steps. It requires only one medium, one incubation temperature, and yields results comparable to counts obtained by the standard MPN procedure within 12 to 18 hours. □



The column flotation unit at National Metallurgical Laboratory, Jamshedpur

Column Flotation Technology for Indian Mineral Industries

IN conventional flotation, ores/minerals are subjected to roughing in a series of mechanical flotation cells followed by cleaning in various stages to obtain concentrates of specified purity. This involves many unit operations with additional cost of processing. On the other hand, the column flotation technology developed indigenously at National Metallurgical Laboratory (NML), Jamshedpur, for the beneficiation of various industrial ores/minerals offers many advantages, viz., simplicity of operations, improved grades of the concentrates with good recovery, considerable savings in power and improved economy. The 3" diameter fully automated column cell de-

signed and developed at NML has been successfully used to carry out feasibility studies on copper ores, iron ore, fluorspar, lead and zinc ores and complex multisulphide deposits. The results obtained in all these studies are encouraging and have yielded excellent metallurgical results. The column flotation technology will hence forth be available indigenously and eliminates the dependance of foreign knowhow in this field.

Flotation is a process which exploits the surface properties of minerals. In a conventional mechanical type of cell, the ore slurred with water and conditioned with frother and collector is agitated by a stirring mechanism with aeration. The valuable mineral that is usually hydrophobic collects in the form of froth which is removed from the cell as a concentrate and processed further. The turbulent conditions existing in the cell along with bigger air bubbles results in the loss of valuable mineral which returns as tailings. Further, the short retention times and bigger air bubble sizes decrease collision probability between the fine particles and the bubbles resulting in decreased yields.

How does a column work?

In a column flotation cell, the ore in the form of slurry comes in contact with a counter current rising flow of air bubbles generated at the bottom of the cell by a sparger. The descending column of slurry carrying solids has thus longer retention time due to its contact with ascending quiescent air bubbles increasing the collision probability. The froth, which collects on the top of the cell, is further cleaned by a water spray which removes the ad-

hering hydrophilic particles resulting in improvement in the grade of the concentrate. To sum up, column cells are characterized by lower energy requirements, less maintenance, less capital investments, savings in workspace requirements, etc.

Column cells are replacing conventional cells in the cleaner circuits in most of the mineral beneficiation plants throughout the world. NML had recognised this fact as early as in 1987 and concentrated its efforts in this particular field of technology. It has successfully designed and developed a fully automated 3" diameter column cell which can be used as a research tool to carry out feasibility studies on various industrial minerals.

Feasibility studies of column flotation to improve the quality of copper concentrate have been conducted at Malanjkhand Copper Project of M/s. Hindustan Copper. The studies included, besides optimizing the column cell parameters, collection of specific data pertaining to improvements in copper concentrate grades and overall copper recovery.

Laboratory studies carried out on Malanjkhand copper rougher concentrates using column cell in place of conventional cell revealed that the acid insolubles (gangue minerals) could be reduced from 13-16% to 2-4% with an additional copper recovery of 2-3% in the final concentrate. These results were further confirmed by implant trials at Malanjkhand Copper Project. The implant trials were carried out using 3" diameter NML column by drawing out desired quantity of on-stream copper rougher concentrates, 13-22% copper and 20-45% acid insolubles.

A final copper concentrate, 27-34% copper with 2-4% acid insolubles, could be produced in

column cell in a single stage cleaning whereas it was possible to produce copper concentrate containing 26-31% copper and 12-16% acid insolubles only with two stages of cleaning as presently practised at the plant.

The adoption of column technology for MCP rougher concentrate is expected to yield the following benefits to M/s HCL-MCP, viz, metallurgical benefits of improved quality and recovery of copper with better performance, simplified flow sheet and layout with attendant benefits of savings in space, ease of operation, maintenance, savings in power and transportation costs by way of transport of reduced quantity of concentrates carrying less acid insolubles to their smelter, etc. M/s Hindustan Copper Ltd is planning to implement the suggestion of NML to install column cells in place of their existing cells. □

Seminars, Workshops & Symposia

New Horizons in Analytical Chemistry

A seminar on 'New Horizons in Analytical Chemistry' was organized recently at the Indian Institute of Chemical Technology (IICT), Hyderabad, as a part of its Golden Jubilee Celebrations. Prof. A.R. Kidwai, Governor of Bihar, inaugurated the seminar and stressed the importance of analytical chemistry in different facets of chemical industry. In his inaugural address he touched upon the changed scenario of Indian economic policy which has brought in globalization. Only goods of excellent quality can therefore be traded in future, he said, which necessarily demands greater inputs of analytical chemistry and use of refer-



Seated on the dais during the seminar on 'New Horizons in Analytical Chemistry' (from left) are : Dr Sajid Husain, Dr U.T. Bhalerao, Prof. A.R. Kidwai and Dr Varadarajan.

ence standard materials. Modern techniques of analytical chemistry along with computer-assisted methodologies are likely to play a leading role not only in producing goods of excellent quality but also in developing eco-friendly technologies. Prof. Kidwai lauded the efforts of IICT in this direction.

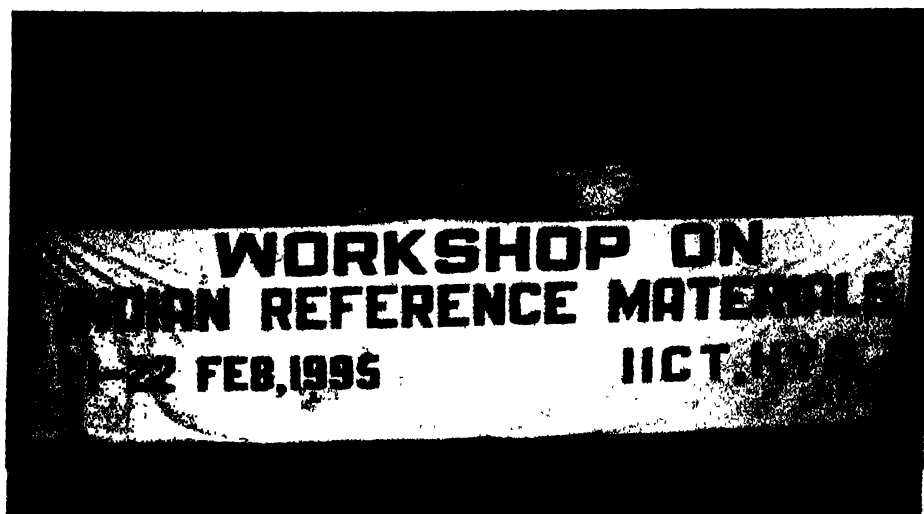
Dr S. Varadarajan, Chairman, Research Council of IICT, presided over the inaugural session. Dr U.T. Bhalerao, Director Grade Scientist, IICT, welcomed the participants. Dr Sajid Husain briefed the participants about the theme and objectives of the seminar. He highlighted the major contributions made by Analytical Chemistry Division of IICT in transferring process knowhow from IICT to industry and in solving complex problems of industry and public sector undertakings. He also briefed the participants about the achievements of the division in basic research and contributions made towards human resource development. Dr M. Vairamani proposed a vote of thanks. About 240

delegates from India and abroad participated in the seminar.

Nine plenary lectures and three invited talks were delivered by the experts in the field. Twenty seven technical papers were presented in the technical session and 75 papers were presented in the poster session. The technical programme was divided into seven sessions covering different fields of analytical chemistry such as chromatography, spectroscopy, electrochemistry, hyphenated techniques, environmental analysis, process analytical chemistry and recent developments in conventional methods of analysis. An exhibition of analytical instruments was also organized in which 12 leading Indian manufacturers of instruments took part. □

Indian Reference Materials

A workshop on 'Indian Reference Materials (IRM)' was organized recently at Indian Institute



Dr Krishnan Lal delivering his address at the workshop on 'Indian Reference Materials'. Others seen on the dais (from left) are: Dr Sajid Husain, Dr U.T. Bhalerao, Dr T.R. Baggi, and Dr P.K. Gupta

of Chemical Technology, Hyderabad. Indian Reference Materials is a CSIR Thrust Area project initiated in 1990 by the National Physical Laboratory, New Delhi, to prepare indigenous standards which are essential for quality control and quality assurance work of industrial chemicals and also for environmental analysis and monitoring.

About 35 delegates from different CSIR laboratories and other R&D institutions took part in this workshop. Dr T.R. Baggi, Director, Central Forensic Science Laboratory, Hyderabad, inaugurated the workshop. In his inaugural address, he stressed the role of certified reference materials in analytical chemistry. He said that these materials could play a vital role in producing goods of excellent quality and also in developing eco-friendly technologies. Dr U.T. Bhalerao, Scientist (Director Grade), IICT, welcomed the delegates.

Dr Krishan Lal, Scientist (Director Grade), National Physical Laboratory (NPL), New Delhi, highlighted the work carried out on Indian Reference Materials. He added that reference materials are needed in the preparation of ul-

trapure grade materials — the building blocks of modern industry. Inter-laboratory work has been initiated by NPL in 1990 to validate reference materials and calibrate sophisticated instrumental facilities.

Dr P.K. Gupta, Deputy Director, N.P.L., New Delhi, briefed the participants about the theme and objectives of the workshop. Dr Sajid Husain, Deputy Director & Head, Analytical Chemistry Division, IICT, proposed the vote of thanks.

Fourteen invited talks were delivered by scientists on techniques like spectroscopy, chromatography, electrochemistry, importance of standard reference materials, preparation of reference materials and solutions, and pesticide analysis. The status report on 'Indian Reference Materials' was presented in the workshop. The status of IRM project and its future programmes were also discussed. The workshop was partly financed by Human Resource Development Group of CSIR. □

Computerized Battery Testing facility at CECRI

CENTRAL Electrochemical Research Institute (CECRI), Karaikudi, has installed a well equipped computerized automatic battery testing facility at CECRI, Madras centre, Taramani.

The Madras centre has excellent test facilities such as automatic, life cycling unit, vibration testing machine, DC electronic resistors, high rate dischargers, etc., which have been functioning for the past two decades. Apart from lead acid batteries, allied components such as separators, sealing compounds and raw materials are also tested. The testing services are also extended to other types of batteries like dry cells, lithium sulphur dioxide cells, nickel cadmium batteries, etc. Batteries of different types are tested for small, medium and large scale industries in India. The testing is done as per Indian and international standards. The computer facility is multiple circuit, microprocessor-controlled battery cycle life test system. Each unit can be programmed to cycle batteries precisely according to BIS, RDSO, JIS, SAE, DIN, BCI and other MIL specifications or to perform reserve capacity and charge acceptance tests.

At present, the facility has seven charge and discharge modules, with a peak current of 250A (charging and discharging) and peak voltage of 36 V (charging) and 24 V (discharging). The centre is now geared to take up testing of batteries even from foreign customers. □

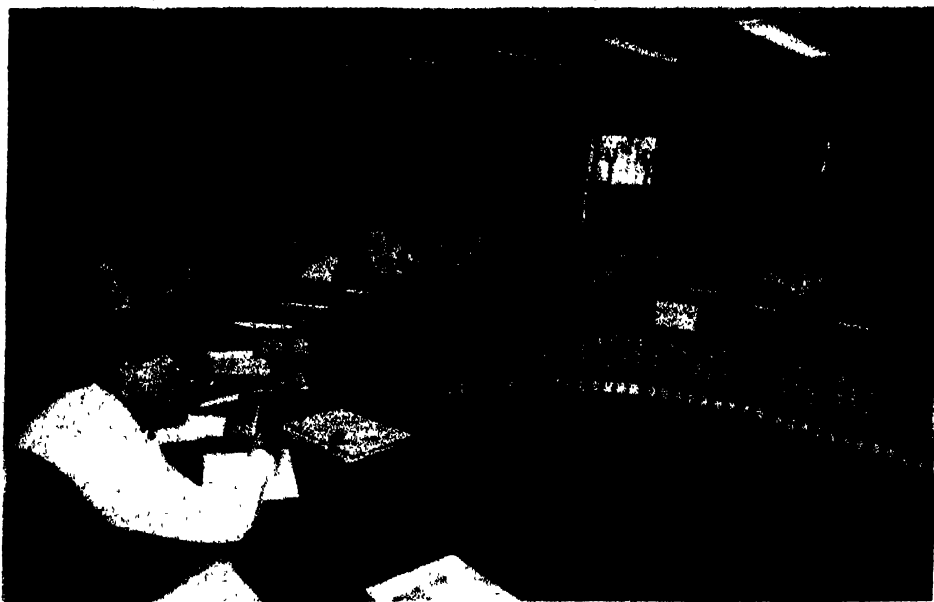
Standards in CSIR Laboratories and Interaction with Industries

A day and a half long Meet of CSIR laboratories on 'Role of Standards, Calibration, Testing, Accreditation and Quality Systems in CSIR Laboratories and Interaction with Industries' was held at National Physical Laboratory (NPL), New Delhi, on 19 and 20 May 1995. More than 30 CSIR laboratories participated in the meet. Lectures on the subject were delivered by Shri S.K. Chowdhary, Director, Bureau of Indian Standards, Shri J.S. Raju, Director General, Standardization Testing and Quality Certification, and Shri A.K. Chakravarty of the Department of Science & Technology. Fifteen Laboratories gave details on their activities concerning the subject.

The meet began with a welcome address by Prof. E.S.R. Gopal, Director, NPL. It was followed by a talk on the main theme by Dr. K. Lal of NPL. Prof. V.K. Gaur, Chairman, Technical Advisory Board (PEM), emphasized the crucial role

of standards and precision measurements in enhancing quality in all spheres of life.

Prof. S.K. Joshi, Ex-Director General, CSIR, addressed the participants on 20 May. He first referred to a meeting held at the Ministry of Industry on 19 May, 1995, on the current techno-economic developments and the role of National Quality Council, and what was expected from CSIR laboratories in that context. He said that many CSIR laboratories were still following the old system and were not aware of the changed circumstances. Expressing the hope that problems and issues discussed during the meet would be pace-setting, Prof. Joshi said CSIR laboratories will have to mobilize their collective strength. There was a need for CSIR laboratories to establish their credibility and strengthen their links with industries by providing technological services. The CSIR, he said, would certainly support new innovative endeavours but support for R & D applications must be sought from industry.



The Meet of CSIR laboratories on 'Standards, Calibration, Testing, Accreditation and Quality systems' in progress at National Physical Laboratory, New Delhi

New publication

Role of Metrology in Quality Management and Improvement

THE book on *The Role of Metrology in Quality Management and Quality Improvement* was released by Prof. S.K. Joshi, Ex-Director General, Council of Scientific & Industrial Research, on 12 May 1995 at National Physical Laboratory (NPL), New Delhi. Prof. E.S.R. Gopal, Director, NPL, welcomed Prof. S.K. Joshi and other guests and Dr. B.S. Mathur, the Editor (along with Shri A.C. Gupta and Dr. V.N. Ojha) gave a brief introduction to the book. This 400 page compilation is based on a training programme arranged at NPL for participants from Commonwealth, NAM and Asia/Pacific



countries in May-June, 1994, and contains 46 articles on "Metrology and Calibration" and "Quality Management and Quality Improvement". Those present on the occasion, besides senior scientists of NPL, were Dr. A.P. Mitra, Ex-Director General, CSIR, Dr. A.R. Verma, Ex-Director, NPL, and some visitors from PTB, Germany. □

Dr. B. S. Mathur, Convenor, thanked the participants of the meet which was followed in the afternoon of 20 May by the first Meeting of the reconstituted Technical Advisory Board on Physical, Earth and Marine science and technology, including Environment (TAB-PEM). Some of the activities presented during the meet were discussed at the TAB (PEM) meeting for further action.

A consolidated proposal on "Renovation and Modernization of Industrial Calibration and Testing Facilities" for all CSIR laboratories involved in calibration/testing work is under preparation and will soon be submitted to the Planning Commission. □

Anti-corrosion Technologies — Demonstration with Product Exhibition

THE Central Electrochemical Research Institute (CECRI), Karaikudi, has recently developed a few anti-corrosion technologies which have reached the prototype

demonstration stage and are ready for commercial exploitation. As these technologies are in demand, there is a need for a closer interaction between CECRI and prospective entrepreneurs and users. Prototype demonstration is an ideal method of convincing the potential entrepreneurs about the reliability of a product or process. Field problems that may arise during scaling up operation, acceptance tests, product specifications, durability aspects and cost effectiveness need also to be discussed.

With these objectives in mind, CECRI organized a two day programme on exposition and demonstration of some selected anti-corrosion technologies developed at the Corrosion Division of the institute. Entrepreneurs, users and senior level executives from various organizations such as Ministry of Surface Transport, Steel Authority of India Ltd, Larsen and Toubro Ltd, Oil and Natural Gas Corporation, Ramco Cements Ltd, Devika Chemicals Ltd, Fosroc Chemicals Ltd, W.S. Industries Ltd, M/s. Sentinel Chemical Industries, etc., participated in the

programme. The programme was inaugurated on 27 June 1995 by Dr R. Krishnan, Director, Gas Turbine Research Establishment, Bangalore. Prof. G.V. Subba Rao, Director, CECRI, presided over the inaugural function. Dr N.R. Rajagopal, Head, Human Resources Development, CSIR, New Delhi, declared open the exhibition of corrosion products developed at CECRI. Dr K. Balakrishnan, Head, Corrosion Science and Engineering Division, briefly outlined the ongoing R&D activities in the area of corrosion and its control. Dr K.S. Rajagopalan, Executive Vice President, Technology Advance Centre, Madras, Prof. K.I. Vasu, Chairman, National STED Committee, DST, New Delhi, P.F. Anto, Deputy General Manager, ONGC, Bombay, Dr S.R. Rajagopalan, Emeritus Scientist, National Aerospace Laboratories, Bangalore, Shri Kachchwaha, Chief Engineer, Bridges, Ministry of Surface Transport, and Shri S.V.N. Nagappan, Chamber of Industries and Commerce, Karaikudi, participated in the inaugural and technical programmes. The following four technologies were demonstrated.

Electrophoretic paint for coating intricate component parts: In construction industry, thin steel sections, such as, binding wire, chicken mesh, barbed wire, steel network (ferrocement), etc., are used in very large quantities. At present either uncoated or galvanized steel wires are employed. In corrosive environments they have limited durability. Non-metallic materials such as PVC nylon are rather expensive. Ordinary painting of such thin wire sections is uneconomical. CECRI has developed electrophoretic paint technology for this purpose. Samples of wire mesh and barbed wire used for fencing, etc., were electropainted and shown to the participants. Different colours such as red, green, blue, etc., are also



Prof. G.V. Subba Rao, Director, Central Electrochemical Research Institute, delivering the Presidential address at 'Anti-corrosion Technologies: Exposition & Demonstration' held at CECRI, Karaikudi

available. Steel wire manufacturers and paint industry can make use of this technology.

SCADA technology: Cathodic protection is one of the time — tested fool-proof techniques of mitigating corrosion in buried pipelines, buried structures, sea-going vessels, offshore and on shore installations, etc. More recently, cathodic protection of reinforced concrete bridges and structures is also being advocated. Big establishments like ONGC, IOC, port trusts, etc. are investing millions of rupees in cathodic protection. As structures and installations to be protected are huge in dimension, in situ monitoring becomes a practical problem because monitoring has to be done at thousands of points. Automatic remote monitoring is a boon in such situations. CECRI has developed indigenous SCADA technology with data-logging facilities. It uses the existing telecom lines for remote monitoring. CECRI's SCADA technology was demonstrated on a field scale. One of the participants, M/s. Scientific Metal Engineers, Karaikudi, made an on-the-spot decision to obtain the license for the same. The formal transfer of technology took place on 28 June 1995.

Rapid repair technology for concrete structures: It is now being increasingly recognized that the reinforced concrete structures exposed to corrosive marine/industrial environments become susceptible to corrosion-related damage. The conventional repair techniques employed to rehabilitate the damaged structures have many disadvantages. Most important, the repaired structure needs curing and hence utility of the structure gets delayed. Conventional system is either cement-based or epoxy-based. The former requires prolonged water-curing

Petrotech-95

NATIONAL Geophysical Research Institute (NGRI), Hyderabad, participated in the First International Petroleum Conference and Exhibition 'Petrotech-95' held at New Delhi recently. The Petrotech-95 was hosted by Oil and Natural Gas Corporation Ltd. (ONGC). Delegates from major international and Indian companies/organizations covering various upstream and downstream activities of the petroleum industry participated in 'Petrotech-95'.

The NGRI highlighted its scientific and technological expertise in the field of oil exploration with emphasis on potential field, magnetotelluric, deep resistivity, controlled source seismic and airborne geophysical methods. Four research papers dealing with geo-

physical exploration for petroleum were presented in the conference.

A brochure describing the S&T expertise and capabilities of NGRI in various disciplines of earth sciences was brought out on this occasion. Both exhibits and brochure were highly appreciated and commended by distinguished Indian and foreign visitors.

Capt. Satish Sharma, Union Minister of State for Petroleum and Natural Gas, Dr. S.Z. Qasim, Member, Planning Commission, Shri S.K. Mangalik, Chairman, ONGC, and Dr. V.L. Kelkar, Secretary, Ministry of Petroleum, visited the exhibition and showed keen interest in NGRI's contributions in the area of petroleum exploration. □

while the latter requires air curing for a minimum specified period.

Rapid repair technology developed at CECRI is based on sulphur concrete and does not need any curing. Besides, it has very high electrical resistance and resists acids. It is suitable for industrial floorings, bridge substructures, rapid repair of corrosion-damaged electricity poles, offshore jetties, container berths, pavements, etc. It is also cost effective, with high durability. This technology was also demonstrated to the participants. A 1.2 m long rapid-setting concrete beam was cast. It became ready for use within three hours of casting.

Cement polymer shop coating technology: One of the factors for high rate of corrosion in concrete structures is the use of uncoated rusted reinforcements. Obviously, rebar coatings are in great demand. CECRI has developed a ce-

ment polymer coating system with desirable properties. Even the US Department of Transportation has appreciated the concept behind the development of this coating system. This CECRI technology was demonstrated to the participants in an automation unit set up at the institute. The salient features of the coating system was also demonstrated.

The following anti-corrosion products were also exhibited and their commercial viability was discussed with the participants: Aluminium alloy anodes for cathodic protection (based on Indium); anti-tarnishing lacquer for copper and its alloys; manganese phosphating; magnesium alloy anode for cathodic protection; new paint formulation for concrete structures; zinc alloy anode for cathodic protection; low temperature zinc phosphating formulation; rust converting primer; zinc ethyl silicate primer; epoxy silicone-based

Col. Sir R.N. Chopra Museum Inaugurated

RECENTLY, Dr. S.Z. Qasim, Science Member, Planning Commission, New Delhi, inaugurated the museum dedicated to the memory of Col. Sir R.N. Chopra established at Regional Research Laboratory, Jammu. The museum is a befitting tribute to the exemplary work done by Col. Chopra in the area of Pharmacology and Drug Development. The museum displays the manuscripts of his books, meticulously maintained diaries, photographs and his personal belongings.

Col. Sir R.N. Chopra (1882-1973), the founder Director of Drug Research Laboratory, which was christened as Regional Research Laboratory in December, 1957, was the Father of Modern pharmacology in India. Col. Chopra did pioneering work on medicinal plants of India and established the discipline of pharmacology firstly in Tropical School of Medicine, Calcutta, and later in Drug Research Laboratory, Jammu, for detailed pharmacological screening of medicinal plants. His pioneering work on *R. serpentina* laid firm

foundation for research in herbal drugs which is the major R&D thrust area of Regional Research Laboratory, Jammu.

After the formal inauguration of the museum, Dr. Qasim visited Regional Research Laboratory and delivered a lecture on the importance of R&D to be conducted on herbs and other natural resources used in Indian traditional system of medicine. He also highlighted the usefulness of medicinal herbs used in Ayurveda and discussed at length the destructive allopathic drugs and the damage done by them to the human defensive mechanism, particularly the immune system. Dr. Qasim said that the world market for herbs and medicines from plant sources is catching up fast and India could take lead in this field. He pointed out that Neem (*Melia azadirachta*) is a native to tropical countries and is found largely in India, yet much of the research work on this wonder tree is being done in Europe. In the end Dr. S.K. Mehta, Deputy Director, RRL, Jammu, presented a vote of thanks. □



Dr S.Z. Qasim, Member, Planning Commission, New Delhi, inspecting the rare manuscripts authored by Col. Sir R.N. Chopra

heat-resistant paint for protecting mild steel structures; heat-resistant, anti-corrosion, air-drying coating using silicone titanate resin; water-borne, rust-converting primer (neutral) based on chlorinated rubber resin; epoxy powder (aqueous suspension) anti-corrosive coatings; epoxy powder for powder coatings; reflecting road marking paint; and fluorescent and reflecting paint for signboards. □

Patents Filed by CSIR Scientists

Patent Application No. 1734/DEL/94. **An improved process for the manufacture of Hydroxy citronellal from citronellal eucalyptum citriodora oil.** Inventors: S.K. Agarwal, Mohd. S. Siddiqui, K.K. Agarwal and S. Kumar, Central Institute of Medicinal and Aromatic Plants, Lucknow.

Patent Application No. 1735/DEL/94. **Micro stress relieving in time temperature domain for improving corrosion resistance of the surface.** Inventors: D. Mukherjee and Dwijotton Mukherjee, Central Electro Chemical Research Institute, Karaikudi.

Patent Application No. 1736/DEL/94. **A novel alternative building material.** Inventors: S.P. Agarwal and S.K. Dolui, Central Building Research Institute, Roorkee.

Patent Application No. 1737/DEL/94. **A process for the preparation of novel diterpenoid.** Inventors: S. Kumar Chattopadhyay, R.P. Sharma and S. Kumar, Central Institute of Medicinal and Aromatic Plants, Lucknow.

Patent Application No. 1738/DEL/94. **A device for separating stigma and style from the pistil of flowers.** Inventors:

New Publication

Rural Roads in India (in Hindi)

THE Central Road Research Institute, (CRRI), New Delhi, has brought out a document in Hindi entitled, *Bharat Mein Gramin Sarak Vikas: Pralekha* in two volumes. The document was formally released by Shri K.K. Madan, President, Indian Roads Congress (IRC), at its Council Meeting held at Udhagamandalam (Ooty) on 1 May 1995. Earlier, in 1990, this document *Rural Road Development in India* was published by the institute in English at the instance of Planning Commission and on the sponsorship of CAPART, MOST, and the Ministry of Agriculture (Rural Development).

On this occasion Prof. D.V. Singh, Director, CRRI, briefly described the road network scenario in India, particularly connectivity of six lakh villages for their economic development. Prof. Singh stressed the need of using locally available material for the construction of low volume roads. He stated that in view of its increasing demand by the practicing engineers from various quarters in India and to make this document available to the people



Shri K.K. Madan, President, Indian Road Congress, releasing the document on Rural Roads in India in Hindi

engaged in construction work at the grass root level, it was decided to translate the document into Hindi. The Parliamentary Committee on Rajbhasha also recommended the Hindi translation of the document.

While releasing the document Shri K.K. Madan, President, IRC, appreciated the efforts of CRRI in bringing out this useful document and hoped that this document will go a long way to help and guide the road industry.

The document has been brought out in two volumes. The Vol. I deals with the development profile of rural roads and related programmes, socio-economic issues, planning, management and financing; the Vol. II deals with engineering issues, alignments, materials, design construction and maintenance.

The document can be had from: The Director, CRRI, Delhi-Mathura Road, New Delhi-110 020. □

J.K. Sama, B.L. Raina and A.K. Bhatia, Regional Research Laboratory, Jammu.

Patent Application No. 1739/DEL/94. **A process for the preparation of 2,3 & 5-trimethyl phenol.** Inventors: G. Salvapati, K.V. Ramanamurty and T. S. Anjaneyulu, Indian Institute of Chemical Technology, Hyderabad.

Patent Application No. 74/D/DEL/94. **An improved process for the preparation of**

sol-gel boehmite. Inventors: K.G. Warriar, A.D. Damodaran, T.V. Mani, P.K. Pillai, RRL, Trivandrum and M.V. Murugappan and P.S. Jayan, Carborandum Universal Ltd., Madras.

Patent Application No. 75/DEL/95. **A seeding composition useful for the preparation of abrasive alumina from boehmite.** Inventors: K.G. Warriar and A. Damodaran of Regional Research Laboratory, Trivandrum, and M.V. Murugappan and P.S.

Jayan, M/s Carborandum Universal Ltd., Madras. ♦

Patent Application No. 76/DEL/95/. **An improved process for the preparation of modified non-fused sol-gel alumina abrasive grains.** Inventors: K.G. Warriar and A. Damodaran of Regional Research Laboratory, Trivandrum, and M.V. Murugappan and P.S. Jayan of M/s Carborandum Universal Ltd., Madras.

Prof. Dhar leads delegation to Czech and Slovak

PROF. Bharat B. Dhar, Director, Central Mining Research Institute, Dhanbad, recently led a scientific delegation to Czech and Slovak Republics to sign protocols on Scientific Cooperation between Council of Scientific and Industrial Research, India, and the Academy of Sciences of Czech Republic, Prague, and Academy of Sciences of Slovak Republic, Bratislava.

The other members of the delegation were Dr S.V. Gangal, Director, Centre for Biochemical Technology; Dr M.G. Kulkarni, Scientist, National Chemical Laboratory; and Shri B.C. Sharma, Deputy Adviser, CSIR, New Delhi.

The Indian team was in Czech from 18 to 22 June 1995. It held discussions with representatives of Academy of Sciences of Czech and visited various R&D laboratories of that country to explore the areas of cooperation between the two countries for the period 1995-97. The team also identified the areas of mutual cooperation with the Slovak Academy of Sciences during its visit to Slovak from 22 to 26 June 1995. They also signed protocols with both the countries on behalf of CSIR. □



Prof. B.B. Dhar, Director, Central Mining Research Institute, Dhanbad, and Leader of CSIR delegation, exchanging protocols with Dr Jiri Niederle (Top), President, Council of International Academy of Sciences, Czech Republic, and Prof Tine Jozef, (Bottom) First senior Vice President and Deputy President, Academy of Sciences, Slovak Republic

Propane Burner Testing facility at CMRI

CENTRAL Mining Research Institute, Dhanbad, is now fully equipped to carry out the 'Propane Burner Testing of Underground Conveyor Belting' as per IS : 3181 - 1992. This is the first

facility of its kind in India. The facility will fulfil the long awaited need of the manufacturers and users of conveyor belting and the certifying agencies. □

Patent Application No. 174/DEL/95. **A data acquisition system useful for underground mines.** Inventors: S.C. Srivastava, L.K. Bandyopadhyay, S. Srivastava, S. Sinha, S.K. Sinha, M.K. Dutta, E. Tudu, P. Thakur and Radhey S. Srivastava, Central Mining Research Institute, Dhanbad □

Seventh National Conference on Machines and Mechanism (NACOMM-95)

January 20-21, 1996

Venue : Central Mechanical Engineering Research Institute, Mahatma Gandhi Avenue, Durgapur 713 209

Aims: To assess the current status of indigenous expertise, identify the needs of the industry and define the profiles of future R&D activities to develop globally competitive products.

Programme: Technical Sessions, Invited Lectures, Exhibition.

TOPICS

- Design and analysis of machine elements
- Rotor dynamics
- Hydraulic, pneumatic and electrical drives and controls
- Dynamics of systems and controls
- Computer aided design
- Design for manufacture
- Product development and evaluation
- Reliability and quality control
- Robotics and automation
- Biomechanics
- Case studies
- Mechanisms for toys, models and animated units.

For further information on presentation of papers, sponsorship, advertisement in the souvenir, exhibition, etc., please contact:

The Convener, NACOMM-95, Room No. 4, CMERI, Durgapur 713 209. Telephone : 0343-86749, Fax (0343) 86506, 86745, Telex 9005-215.

Doctorate

K. Sita Devi

MS. K. Sita Devi, Scientist, Analytical Division, Indian Institute of Chemical Technology (IICT), Hyderabad, has been awarded Ph.D. degree by Osmania University, Hyderabad, for her thesis entitled 'Characterization of minor seed oils by modern analytical techniques and their utilization for industrial purposes'. She carried out research under the supervision of Dr Sajid Husain, Deputy Director and Head, Analytical Division, IICT.

Her work is a comprehensive study on the role of fatty acids in industry with particular reference to conjugated fatty acids, their separation, isolation, identification with the help of HPLC and end-use mainly as phenolic lacquers. The oils containing conjugated fatty acids employed in this study form viable alternatives to tung oil which is becoming scarce and is not indigenously produced. The study also includes the determination of some important physico-chemical properties of the oils such as vapor pressure, heat of vaporization, activity coefficient, among other things. Statistical modelling of fatty acid composition for the determination of adulteration in oils and their blends was also undertaken in the study. Basically, the study contributes to the commercial utilization of vegetable oils in the present day industry. □

Awards and Honours

Anjana Mazumder

DR Anjana Mazumder, Scientist EI, Indian Institute of Chemical Biology, Calcutta, has been admitted as a Member of the Royal Society of

A New Herbarium at RRL-Jammu

A new Herbarium has recently been set up in the Botanical Sciences Department of Regional Research Laboratory, Jammu. It was inaugurated by Prof. Man Mohan Sharma, FRS, Director, Department of Chemical Technology, Bombay. Equipped with most up-to-date nomenclature system, this Herbarium has been recognized internationally. The acronym RRLH has been assigned to it which is registered in Index Herbarium at New York, U.S.A.

The Herbarium at present houses more than 18,000 specimens, representing 2,800 species and 1,050 genera belonging to 150 families of angiosperms, gymnosperms and ferns. The special feature of this Herbarium is that the flora of North-West Himalayas is very well represented. The preserved specimens of the Herbarium include a large number of medicinal, aromatic and other economic plants from different parts of India and abroad. Besides technical details, habit, habitat, flowering and fruiting time of every specimen has been properly maintained in the herbarium for ready reference and for use by the herbal drug industry for authentication of plant material. The entire information on the plants preserved in the herbarium is in the process of being computerized. □

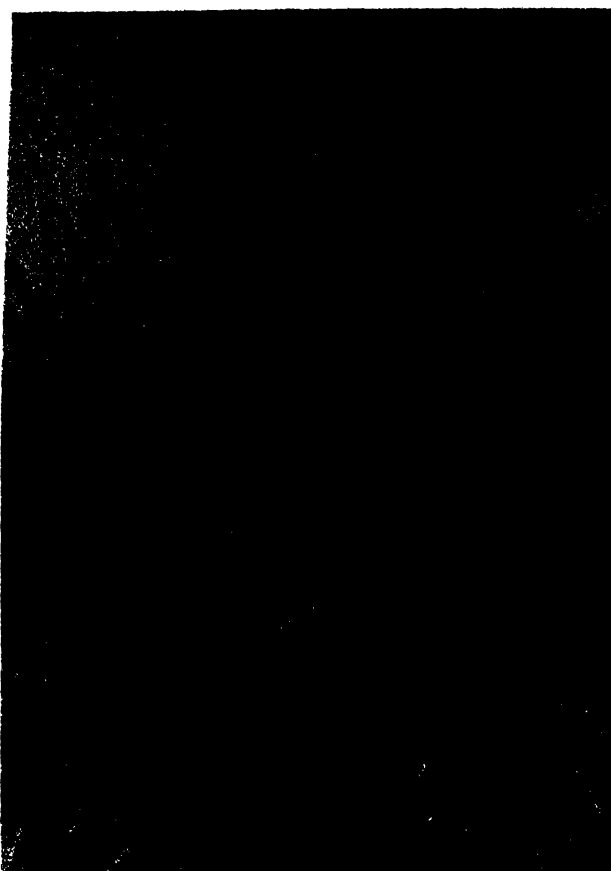
Chemistry and is entitled to use the designation Chartered Chemist.

Amal C. Dutta

DR. Amal C. Dutta, Scientist, Central Fuel Research Institute Dhanbad, has been awarded 'International Dr. Yudhvir Singh Memo-

Eugenol-rich *Ocimum* variety released

REGIONAL Research Laboratory (RRL), Jammu, recently released a *Clocimum* variety to a private party for commercial multiplication on the field for eugenol. It is a result of collection and evaluation of a good gene pool of different geographical races of *Ocimum gratissimum* L. from both indigenous and exotic sources. A hybrid strain of *Ocimum gratissimum* L. has been developed and named as "Clocimum" using recurrent selection (FCA) technique of breeding. This "Clocimum" variety has 60-65% eugenol and 10-15% myrcene based on essential oil yield of 0.5% (F.B.).



The new, improved eugenol-rich variety of *Clocimum* called 'RRL-Og-14'

The RRL scientists have also developed another heterotic F1 strain of *Ocimum* and named it as *Clocimum-3c* which contains 90-95% of eugenol. This improved

eugenol-rich variety has also been released to the private and commercial farmers under the trade name RRL-Og-14. □

rial Award - 1995' by the Executive Committee of Hahnemann Birth-day Celebration Committee, Delhi

Prof. T. Viswanathan becomes President of FID/CAO

IN its 13th General Assembly and Congress held at Jakarta (Indonesia) from 6 to 8 June 1995, the International Federation of Information and Documentation — Commission on Asia and Oceania (FID/CAO) unanimously elected Prof. T. Viswanathan, Director, In-

dian National Scientific Documentation Centre (INSDOC), New Delhi, as its President for a two year period (1996-1997). As per the convention, Prof. Viswanathan will take over the office of President on 1st January, 1996, from Mr Ian Dickson who served as President of FID/CAO from 1989 to 1995. Prof. Viswanathan is the first Indian to take over as President of FID/CAO.

FID is the oldest international organization of institutions, professionals and users. It is celebrating the Centenary of its foundation

in October, 1995. The mission of FID is "to initiate, develop and facilitate global and integrated information programmes, activities and networks to process and deliver information recognizing that information is the critical resource for all levels of society". FID carries out a large variety of programmes and activities which are implemented through Regional Commissions, Special Interest Groups, and various committees.



The Regional Commissions are the most important mechanism for implementing the FID programmes. FID has also Regional Commissions in other regions: Western, Eastern and Southern Africa (FID/CAF), Latin America (FID/CLA), the Caribbean and North America (FID/CNA), North Africa and the Near East (FID/NANE), Regional Organization for Europe (FID/ROE).

The FID Commission for Asia and Oceania was set up in 1967 and is one of the most active regional organizations of FID. Twenty three nations of Asia and Oceania, comprising over 60% of the total world population, are the members of FID/CAO.

INSDOC will host the 50th FID Congress and General Assembly in 1998, which is expected to be attended by about 2000 delegates from all over the world. The 14th General Assembly and Congress of FID/CAO will also be held in India in 1997. □

Printed and Published by Dr G.P. Phondke, Director, Publications & Information Directorate (PID), Dr K.S. Krishnan Marg, New Delhi - 110 012

Printed at PID Printing Unit

Editors : Dr B.C. Kashyap, Dilip M. Saini and Madhu Sahni

Production : Kanchal Kishore

Phone: 5786301

Gram: PUBLIFORM

Telex: 031-77271

E-mail: pld@aimetd.ernet.in

Fax: 5787062

Annual Subscription : Rs. 60

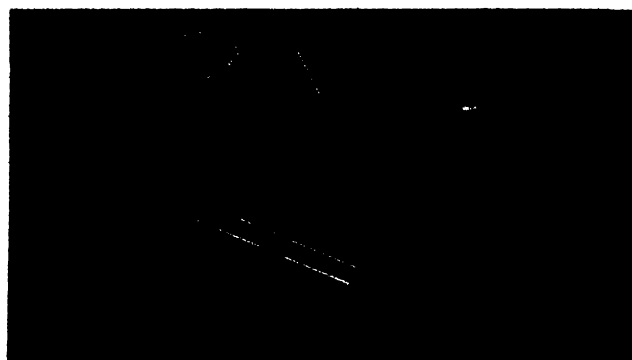
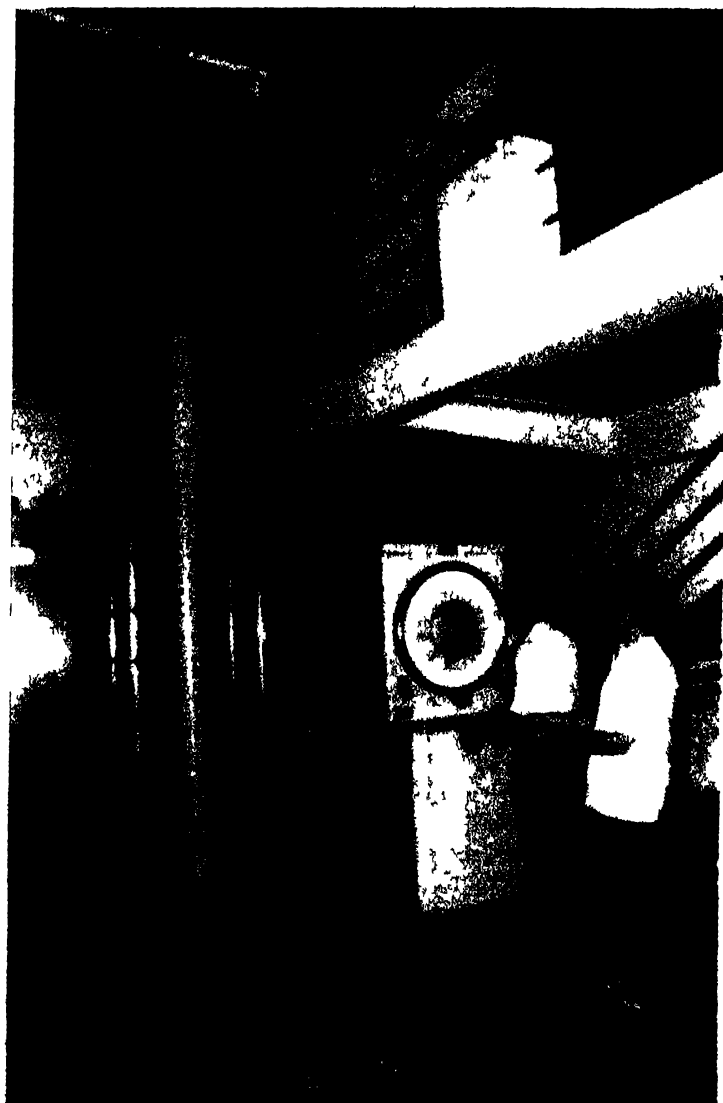
Single Copy: Rs. 3.00

CSIR

NEWS



VOL 45 NO 17 15 SEPTEMBER 1995



Rigid steel prop with remote release mechanism for supporting mine and tunnel roofs developed by Central Mining Research Institute, Dhanbad (Left). Nickel chromium plated steel tubes (Top) developed at Central Electrochemical Research Institute, Karakudi. R&D highlights of this institute appear on page 258.

IN THIS ISSUE

Central Electrochemical Research Institute, Karakudi R & D Highlights 1993-94	258
Government-Industry R & D Interface	262
Alternate Charge Materials for Electric Arc & Induction Furnaces	265
New PID Publications	268

Central Electrochemical Research Institute, Karaikudi

R & D Highlights : 1993-94

THE R & D activities of Central Electrochemical Research Institute (CECRI), Karaikudi, pertain to corrosion science and engineering, batteries & fuel cells, electrochemicals, electrochemical material sciences, electrodes and electrocatalysis, electrometallurgy (hydro and pyro), industrial metal finishing and electrochemical electronics and instrumentation. Corrosion science and engineering and batteries and fuel cells have been identified as the thrust areas.

CECRI's accomplishments in R & D efforts during this period are considerable. Fifteen processes of CECRI have been passed on to industry whereas thirteen processes have been demonstrated. Three new processes have been developed; sixteen patents have been filed and eighty six research papers have been published. More than hundred parties have been benefited by direct and indirect assistance whereas five licences have been given assistance. CECRI's efforts to tap resources from Extra Budgetary Resources during 1993-94 have yielded about Rs. 10.6 million through contract research. Some of the significant R&D activities of the institute are as follows:

Corrosion science and engineering

Repair and rehabilitation of corrosion damaged reinforced concrete structures: A rapid repair technology was developed and its field performance was evaluated on a corrosion damaged R.C.C. pole. Evaluation over a period of 8 months revealed that the new repair technology could confer effi-

cient corrosion protection to steel rebars against chloride attack. Bonding of the new overlay over the old concrete substrate has been found to be good. Electrical resistivity of the new overlay was very much higher than conventional concrete.

Rapid setting primer for reinforcing steel and prestressing steel: An improved formulation for a rapid setting primer useful for corrosion protection of reinforcing steel and prestressing steel was developed and patented. The primer was found to pass the one hour

ties. A report has been submitted to M/s. IEOT, ONGC, Bombay.

Automatic control system for cathodic protection: For monitoring and control of cathodically protected offshore structures, a supervisory control and data acquisition system (SCADA) has been developed. The development of SCADA consisted of: (a) Hardware design of the control system for maintaining the structure under corrosion-free region; and (b) A software programme for monitoring the cathodic protection (CP) from control room.



Electroformed components made at CECRI, Karaikudi

The present control and monitoring system with its multichannel data acquisition facility is capable of maintaining the entire structure of equipotential state (corrosion-free region). It has the supervisory control facilities for both sacrificial and impressed/hybrid CP systems.

The above developed control system has been installed at Bombay offshore platform for monitoring the CP system and data acquisition of the piles supporting the platform. The system performance was demonstrated at Bandra (Bombay) using satellite telecommunication network. As an extension of this work, a centralized HUB system has been developed for monitoring various CP stations.

Corrosion prevention of GI wires used for barbed wire fencing: The barbed wires used for fencing get corroded in a short period. Different protective schemes were evaluated and based on the results and also taking into account the local conditions suitable protective

impressed voltage test and chemical resistance test as per standards.

Evaluation of impressed current anodes and galvanic anodes: Different types of galvanic anodes and impressed current anodes, both indigenous as well as imported ones, have been evaluated for their chemical composition, open circuit potential, behaviour, anode efficiency and anodic consumption capacity. Biofouling studies have also been carried out using cupronickel alloy anodically dissolved at different current densi-

schemes were suggested to PWD, New Delhi.

Painting buses: Six buses of Maruthupandiyar Transport Corporation (MPTC) plying in coastal regions as well as in rural areas were coated with zinc ethyl silicate epoxy/zinc phosphate primer followed by epoxide TiO_2 with red oxide. Observations made at the end of six months showed that the performance of paint is good. Four buses of Kattabomman Transport Corporation plying at Tuticorin were also coated with the same types of paint.

Heat-resistant coating : Two types of heat-resistant coating have been developed, one based on silicone-titanate and the other on silicone-epoxy. Both these coatings are unique in that they are of air drying type whereas the conventional high temperature coatings are of stoving type. The coatings have been tested at various sites in some sugar factories with success.

High build epoxy coatings for pipelines located in marine environment: A process has been developed to obtain high build epoxy coating. This coating can be applied over sand blasted/wire brushed surface. It does not need a primer and a top-coat. The coating thickness of 3 mm to 6 mm can be obtained for a single coat.

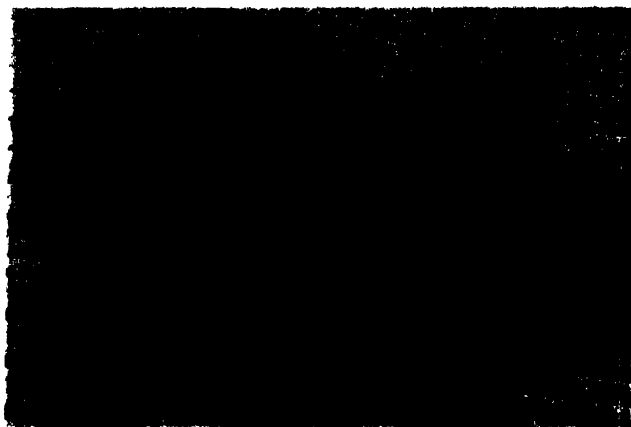
Effect of sea water velocity on the settlement of marine fouling organisms: A continuous flow setup was erected at OPMEC, Tuticorin, for the studies at different flow velocities. The effect of sea water velocity on the settlement of marine fouling organisms on titanium and stainless steel at 1.3 and 6 m/s velocities was carried out. The electrochemical behaviour of these two

alloys at different velocities were also studied. The effect of chlorination for prevention of marine fouling was also studied using the chlorine generator developed by the institute.

It is found that at high velocity conditions the attachment of micro- and macro-fouling is almost nil. The fouling at low velocity can be controlled by the mini-generator of chlorine.

Batteries & fuel cells

Lead-acid batteries: The developmental work in this area is concentrated on designing a prototype high energy density battery using tubular plate design. This design



Four probe resistivity meter developed at CECRI, Karaikudi

facilitates the separation of the conducting elements from the components which contribute to the mechanical support. A 2V/300A module battery suitable for use in electric vehicle has been fabricated and subjected to capacity test and life cycle test. 70 cycles have been completed and further testing is in progress. Tubular plates have been fabricated and the standardization of the pickling process for the tubular plates is in progress.

Molten carbonate fuel cells (MCFC): Fuel cell is a fast emerging technology. The envisaged applications identify fuel cells as an en-

ergy source in remote locations, a replacement for rechargeable batteries, and as alternative for petroleum in vehicle propulsion. CECRI has been actively engaged in the development of MCFC. Components and SS end plates required for the envisaged 100 cm^2 area electrode assembly for testing purposes have fabricated. The design of a bipolar plate for a 1000 A cell stack has been worked out and a model has been fabricated.

Nickel cadmium batteries: Work on the improvisation of Ni-Cd battery cell developed earlier has been taken up. Addition ofazole compounds to prevent deterioration of capacity during cycling has been carried out. Results show that 0.5% triazole addition improves capacity output and also output at a low temperature. Cadmium stannate is being thought of as a substitute for cadmium as it is safer than plain cadmium. Also, the compound is thought to behave better during cycling. Initial results show better performance of the electrodes.

Electrochemical Material Science

CECRI is engaged in the development of efficient semi-conducting materials for solid state and liquid junction solar cells, including septum cells, luminescent materials, including trichromatic phosphors, novel organic conducting polymers and novel oxide materials.

Electrodics and Electrocatalysis

The field of electrodics has been identified as a CSIR Mission Programme. Basic studies on electrodics involving essentially modified electrodes that find applications in a wide variety of fields like sensors, electrochromic de-

electrolytic route only. By the development of modular cells, CECRI brought down the specific energy consumption for the production of magnesium by molten salt electrolysis from 22 kWh to 15-16 kWh per kg of metal. Efforts are in progress to further reduce the energy requirements and the resultant enhanced metal yield. More compactness of the cell with reduced operating and capital costs are the advantages of multipolar cells.

During the year 1993-94, a new type of two module multipolar cell with 500 A capacity bipolar electrodes has been designed, fabricated and experimented. The design includes provisions to channelise the metal flow from the two modules into a common manifold which in turn is capable of discharging the metal into a collecting chamber. A separate chamber to melt the solid cell feed is also incorporated. The cell has been operated to assess its performance.

Several new cell designs with modified and more compact bipolar electrodes, metal ports for effective liquid seal arrangements for preventing air entry into the electrolytic chamber of the bipolar cells, etc, are in progress. The performance of some of the modified bipolar electrodes in small experimental cells has been found promising. A status report on this project has been prepared and sent to the sponsors.

Electrolytic processing of byproduct magnesium chloride: In the manufacture of zirconium at Nuclear Fuel Complex, Hyderabad, magnesium is used as the reductant and anhydrous magnesium chloride is obtained as the byproduct. Work on the process development for molten salt electrolysis of the byproduct magnesium chloride has been taken up under a sponsored programme.

In collaboration with DMRL, Hyderabad, one 15 KA two module multipolar cell has been installed in Hyderabad. This cell has been operated for nearly a month with the modified electrolyte developed by CECRI. Several of the critical parameters have been evaluated to arrive at suitable values for adaptation in connected scale multipolar cells for processing magnesium chloride.

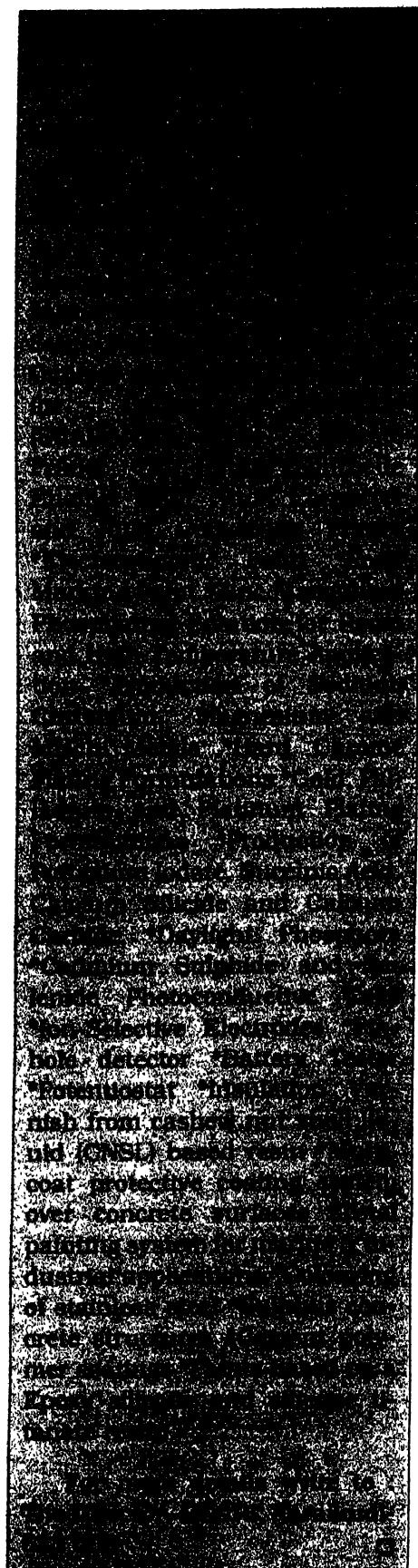
Several versions of snug fit type of bipolar electrodes have been designed and a few have been fabricated and tested. Their initial performance is very satisfactory. It is proposed to scale up these electrodes and test them in large capacity cells to evaluate their performance.

Industrial metal finishing

Electrofabrication: A C-12 cryogenic rocket engine thrust chamber has been electrofabricated and subsequently made available to LPSC(ISRO), Thiruvananthapuram. The electro deposited nickel has been found to have a tensile strength of 52.0-54.7 kg/mm², yield strength of 32.4 - 38.7 kg/mm² and elongation of 19.0 - 23.7% as desired by LPSC.

Plating of composites: Under a programme sponsored by a firm, nickel - diamond composite coatings have been applied on to steel discs for polishing gems. Some discs have been made available to the firm for trials. Nickel diamond composite is also found to be platable on to stainless steel pins for cleaning cavities in teeth.

Electroless plating: A few aluminium metal matrix (MMC) discs from DMRL, Hyderabad, have been suitably preconditioned, electroless nickel plated and also burnished so that they can after flashing with gold be examined for use as mirrors for laser applications. The electroless nickel plated



pieces have been found to satisfy the defence requirements. Tubes of carbon reinforced plastic from ISRO, Bangalore, have been appropriately preconditioned, electroless copper plated, then copper-electroplated and sent back for evaluation.

Instrumentation

The four probe resistivity meter developed for assessing the quality of concrete has been improved. Two improved prototypes were handed over to M/s ACC and Hooghly Bridge Project authorities. Two improved versions of potentiostats were also developed and supplied: one to CECRI Cochin unit and another to CECRI Madras unit. If imported they would have cost 0.1 million rupees whereas the model fabricated here costs only Rs. 43000/-. In collaboration with the Corrosion Science and Engineering Division a pipeline thickness monitor based on resistance measurements was developed. The lab prototype using four probes has given reliable results during field trials. A corrosion monitor (lab prototype) based on the linear polarisation resistance type has been developed for assessing the corrosion of pipelines and steel rebars embedded in concrete. For crack detection in pipelines a four probe based A.C. monitor has been developed and preliminary results using the instruments are quite encouraging. □

Conferences, Workshops & Seminars

Government-Industry R & D Interface

THE Department of Scientific and Industrial Research, New Delhi, (DSIR), organized the Eighth

National Conference on In-house R&D in Industry in association with the Federation of Indian Chambers of Commerce and Industry (FICCI) some time ago in New Delhi. The theme of the conference was 'The Government - Industry - R&D Interface : A Vision for the 90s'. The objectives and highlights of this conference were to provide a forum for dialogue amongst In-house R&D units; to bring In-house R&D into sharper focus; to strengthen linkages between industry, national laboratory system, university system, and Government; and to identify strategies and evolve measures to make the Government - Industry - R&D Interface more effective to enhance our technological and industrial capabilities. Attended by nearly 600 participants from industry, national laboratories, IITs and universities, scientific and industrial research organizations, R&D institutions, consultancy organizations, and Government departments, the conference was inaugurated by Shri Bhuvnesh Chaturvedi, Minister of State for Science & Technology. In his inaugural address the Minister urged the Government, industry and the research and development system to adjust quickly to the new international regime that is coming into force in the sensitive area of patents as a result of upcoming revision in Intellectual Property Rights following India's adherence to the final act of the Uruguay Round of Trade negotiations. The Minister said that to meet the forthcoming challenges in R&D, Indian industry along with the Government and research and development systems have to fashion a strategy, which has to be both defensive and offensive in character and must have one of its key objectives the emergence of our industrial economy as a world player. Exhorting industry to commit more funds for R&D, the Min-

ister said that the industry's share in the national R&D expenditure was only 26 per cent which did not compare favourably with R&D expenditures of some of the developed countries. He told industry to make a commitment to set apart at least 2 per cent of their annual sales turnover for R&D activities to undertake innovative technology development programmes. Apart from providing fiscal incentives for in-house R&D, the Minister said that the DSIR has undertaken a programme of direct funding of R&D project from industry which has already started giving results. He urged the industry to take advantage of the DSIR direct funding scheme. He called on the top management of industry and the R&D organizations to redouble their commitment and to take such steps that at least 30 per cent-if not 50 per cent- of the total industrial production in the year 2000 AD is based on domestically generated technologies. The Minister said that the Government, industry and R&D systems must work together even more closely and effectively for generating and commercializing new technologies for fulfilling national needs. On this occasion, the Minister also presented the 1994 DSIR National Awards for Outstanding In-house R&D Achievements to 12 industrial units: (i) Cheminor Drugs Limited, Hyderabad; (ii) Bharat Heavy Electricals Limited, Hardwar; (iii) Hindustan Aeronautics Limited, Hyderabad; (iv) Accurate Engineering Co. Pvt. Ltd., Pune; (v) T. Stanes and Company Limited, Coimbatore; (vi) Venkateswara Research and Breeding Farm Limited, Pune; (vii) The Associated Cement Companies Ltd., Bombay; (viii) The Gurdit Institute Private Limited, Dharwad; (ix) Sree Rayalaseema Alkalies and Allied Chemicals Ltd., Kurnool; (x) Balmer Lawrie & Co. Ltd., Calcutta; (xi) Modi Xerox Limited, New Delhi;

Recommendations of the Eighth National Conference on In-house R&D in Industry : Some significant highlights

THE following important recommendations arose out of the conference:

- Research and Development (R&D) and technology development are very important activities which should be geared to ensure that the expectations of society from public investments in S&T and from the commitment of industry to utilize the results of such R&D, are actually fulfilled on a time bound basis.
- R&D should become an integral part of corporate planning and the business plans in our companies. There should be a firm commitment particularly on the part of the chief executives of our large companies in both public and private sectors to invest least 2% of their annual sales turnover on R&D by the year 2000 from the average figure of 0.6% today.
- There is urgent need for R&D to be made an attractive career through changes in public policies relating to government laboratories and higher educational institutions as also policies at the enterprise level.
- The syllabi in our educational institutions also require immediate updating and reorientation in line with contemporary S&T internationally.
- Technical advisory cells in select universities, regional engineering colleges and IITs for providing technological inputs to industry should be set up.
- Joint research programmes with active participation from industry right from the concept stage should be pursued.
- Technological information databases and systems to meet the growing needs should be strengthened. Industry should also make active use of the existing R&D-related networks such as ER-Net of DOE.
- Consultancy organizations and financial institutions should be strengthened for enhancing commercialization of technologies.
- Industry-sponsored research programmes in the national laboratories and universities should be encouraged. The Government incentive of 125% Weighted Tax Deduction for sponsored research in national laboratories and universities and IITs should be increasingly availed of by industry. The scheme should also be broadened to cover cooperative research associations.
- The fiscal incentives prevailing today are supply-side based. There is need to complement them with fiscal incentives for commercialization of indigenously developed technologies. The incentives could take the form of income tax holiday for 5 years and excise duty exemption on the production based on such commercialization.
- To respond to the challenge of the forthcoming Final Act of the Uruguay Round of Trade Negotiations, the costs of international patenting including filing and maintenance costs should be treated as R&D expenditure and should become eligible for weighted Income Tax exemption.
- Industry should evolve major multi-agency R&D programmes and increasingly avail of the direct R&D financing schemes of the Government such as PATSER of DSIR and develop competitive technologies utilizing the Government R&D system to the maximum extent possible.
- A nodal cell should be established in DSIR to coordinate all Government supported industrial R&D and technology development programmes and to liaise with industry on a focal point basis. □

and (xii) Pasupati Acrylon Ltd., New Delhi. He also released the DSIR publications, viz., *Compendium on In-house R&D Centres-1994* and *Wealth of Technologies Generated by In-house R&D Centres*.

Prof. S.K. Joshi, Ex-Secretary, DSIR, and Ex-Director General, CSIR, said that according to DSIR analysis, the commercialization factor for R&D in industry during 1993 was 1:25 indicating thereby

that nearly Rs 25,00,00 million to Rs 30,00,00 million turnover has emerged from R&D achievements made by the industry. He also said that there was an urgent need for the small scale industry to focus greater attention on R&D and to increasingly utilize the R&D expertise and facilities available in the CSIR laboratories. He mentioned that nearly 300 in-house R&D units of small scale industries recognized by DSIR are incurring a

total expenditure of Rs 500 million only per year. Prof. Joshi also pointed out that industry has not responded positively to the 125 per cent weighted tax deduction for sponsored research in approved national laboratories, universities and IITs. He called upon industry to take advantage of the fiscal incentives and redouble their efforts in competitive R&D. In his address Dr Bansi Dhar, President, FICCI, said that Indian Industry suffered

the handicap of relatively inadequate business volume to support R&D efforts on its own. He suggested that some fiscal and attractive incentives be given to industry to strengthen their R&D efforts. In his welcome address Shri Ashok Parthasarathi, Additional Secretary, DSIR, said that there was a need for concerted and sustained efforts through networks of manufacturing companies, R&D laboratories, educational institutions and Government institutions for bringing about technological improvement as a continuous on-going creative activity. He further urged the industry to take advantage of the DSIR scheme of co-financing of R&D programmes of industry. Dr V.V. Subba Rao, Joint Adviser, DSIR, proposed a vote of thanks.

The Inaugural session was followed by five sessions, namely, (i) Presentation of their achievements by award-winning companies; (ii) The Government - Industry - R&D Interface : an overview; (iii) The interface in pharmaceuticals; (iv) The interface in information technology; and (v) Financing of R&D. The valedictory session was presided over by Prof. S.K. Joshi. Dr Arjun K. Sengupta, Member Secretary, Planning Commission, was the Chief Guest. In his valedictory address Dr Sengupta observed that in the next 3-5 years no money will be given by the Government to the national laboratories except for supporting basic research. Such institutions will soon facilitate a nexus between the industry and the Government laboratories; Government laboratories will have to do what is dictated by the industry. The benefits accruing out of such industry-sponsored research should be available to the industry which supported it. Government will also consider providing a matching grant to such national laboratories where industry sup-

ported programmes are undertaken, he added.

Another point that was thrown open for consideration was the involvement of younger scientists in decision-making and science management. Dr Sengupta observed that the rate of obsolescence in R&D is very high. Younger scientists should therefore be encouraged. The head of the R&D laboratory or department should be below 45 years. The salary structure of the younger scientists also should be higher and commensurate with their performance. There should be bonus system depending on how much a particular laboratory or a unit has earned and 70% of the bonus should go to the younger scientists in these laboratories who actually perform the research.

Dr Amit Mitra, Secretary-General, FICCI, presented the highlights of the deliberations held during the two days of the conference. Shri Ashok Parthasarathi, Additional Secretary, DSIR, presented the recommendations that arose out of the conference (See box). Dr Amit Mitra then proposed a vote of thanks. □

Microlevel Planning & Rural Development

A one day seminar on 'Microlevel Planning and Rural Development' was organized at Kundrakudi on 29 June 95 by Central Electrochemical Research Institute (CECRI), Karaikudi, Village Planning Forum, Kundrakudi, and Science and Technology Entrepreneurship Development - Task Force for Pudukkottai District. The aim of the seminar was to discuss how micro-level planning would be more helpful for rural development.

In his Presidential address, Prof. G.V. Subba Rao, Director, CECRI, highlighted the salient features of Kundrakudi model of rural development and also felt necessary that our approach to planning should be modified from time to time. He assured that CECRI would continue the type of activities that benefit the common man in the years to come.

In his Inaugural address, Dr H.S. Ray, Director, Regional Research Laboratory (RRL), Bhubaneswar, and also Coordinator for the Rural Development activities in CSIR Laboratories, said that CSIR has several schemes and huge funds for rural development activities. He also said that though CSIR has developed many technologies, effective measures have not been taken to popularise them among rural masses. He also described how technologies developed by RRL - Bhubaneswar were successfully implemented in rural Orissa.

Dr R. Thiagarajan, Former Advisor, Department of Science & Technology (DST), New Delhi, paid rich tributes to the late His Holiness Kundrakudi Adigalar who was instrumental for the success of the Kundrakudi model of rural development and appreciated the involvement and dedication of CECRI scientists, officials of State Government and other institutions for the success achieved in this direction.

Shri P. Srivakumar, I.A.S., District Collector of PMT District, stressed the need for making use of the local human resources and their skills to find solutions to local problems. Prof. K.I. Vasu, Former Director, CECRI, emphasized that macro-level planning will be successful only when micro-level planning is done properly and implemented earnestly. Kundrakudi model was planned in such a way as to achieve develop-



Seminar on 'Microlevel planning and rural development' in progress at CECRI, Karaikudi

ment from all angles, namely, education, health, agriculture, animal husbandry, horticulture, industry, and so on.

His Holiness Ponnambala Desika Swamikal, the new head of the Kundrakudi Matt, highlighted the invaluable contributions made by the late Adigalar for the removal of poverty through careful planning and strict implementation of schemes. He recalled the efforts made by Adigalar in bringing people of various sectors together and harnessing their efforts to improve the status of the poor.

Dr K. Balakrishnan, Deputy Director, CECRI, and Chairman, Village Planning Forum, Kundrakudi, for over a decade, stressed the importance of science and technology inputs in rural development activities. The need for identifying local voluntary organizations to popularise CSIR technologies in rural areas and for interaction with other agencies is very important for effective planning, he said. Dr E.R.R. Iyengar, Scientist, CSMCRI, Bhavnagar, and Shri C.V. Swaminathan, Scientist, CLRI, Madras, and Dr Srinivasan, Agricultural College, Madurai, also participated in the seminar.

vasan, Agricultural College, Madurai, also participated in the seminar.

A felicitation function for Dr K. Balakrishnan, Chairman, Village Planning Forum, Kundrakudi, on the eve of his laying down office as Deputy Director, CECRI, was also held immediately after the seminar. Rich tributes were paid to him for his untiring and selfless efforts put in for rural development activities in close association with the late Dr Thavathiru Kundrakudi Adigalar. Certificates were also distributed to those who had completed their training programmes under Mass Employment Generation through Science and Technology (MEGSAT) programme of DST and tool kits were also handed over to multi-purpose mechanic trainees. Earlier, Shri M. Raghavan, Scientist, CECRI, welcomed the gathering and Shri R. Palanisamy, Scientist, CECRI, proposed the vote of thanks. □

Alternate Charge Materials for Electric Arc & Induction Furnaces

IN collaboration with Indian Institute of Metals, Jamshedpur Chapter, the National Metallurgical Laboratory (NML), Jamshedpur, recently organized a workshop on 'Alternative Charge Materials for Electric Arc and Induction Furnaces' at Jamshedpur. About forty delegates representing SAIL, MECON, BHEL, TAYO, TRL, M.N. Dastur & Co., Ispat Profiles Ltd., Essar Steels, Tata Steel, Orissa Industries, Bihar Sponge Iron Ltd., Orissa Sponge Iron Ltd., Ipitata Sponge Iron Ltd., Shri Gonterman Peipers (I) Ltd. and other R&D organizations, and mini-steel plants attended the workshop. The faculty members for the workshop were from IISc-Bangalore, IIT-Kanpur, BHU, Mini-steel plants and leading R&D organizations.

Alternate charge materials for induction and arc furnaces have a bigger role to play in the coming years in view of the likely scarcity of scraps, quality of the raw materials and the demands placed by ISO 9000 on quality steel-making. Moreover, quality enhancement, standardization, synergy in production control and optimization would play key roles in the near future. The workshop was therefore organized to throw light on the current scene and future technoeconomic features. According to Shri Moosa Raza, Secretary, Ministry of Steel, Government of India, charge materials constitute about 60% of the cost of production of steel through the EAF/IF route. Due to domestic shortage, the industry has to go in for the import of steel melting scrap. The availability of scrap is likely to decline sharply all over the world in the coming years. The World Steel Dynamics has recently forecasted



Shri A. Parthasarathy, Additional Secretary, DSIR, releasing the volume of the workshop proceedings of 'Alternative Charge Materials for Electric Arc and Induction Furnaces'.

metallic shortage of over 110 million tonnes by 2010. Besides, the availability of scrap in domestic market is also likely to reduce with the adoption of new technologies and the setting up of new steel units. The industry would therefore urgently need to explore the use of alternative charge materials, such as, pig, iron, hot metal, iron carbide, etc., together with increased use of sponge iron. It is in this context that the workshop assumes considerable significance.

While welcoming the gathering, Shri K.N. Gupta, Chairman, Organizing Committee, highlighted the key developments in the use of alternative charge materials in electric arc and induction furnaces. Dr K.K. Mishra, Chairman, Technical Committee, emphasized the importance of the workshop in the steel city of India and said that the need of the hour was to produce hot metal with 'S' & 'P' lower than 0.020% for producing steel in mini-steel plants.

While inaugurating the workshop, Dr T. Mukherjee, Vice President (Operations), Tata Steel, stressed the fact that scrap is likely

to become a scarce commodity in the country in future and mini-steel plants may have to fight for their very existence due to the increased production of steel in integrated steel plants. In his address Prof. P. Ramachandra Rao, Direc-



Dr T. Mukherjee, Vice President (Operations), Tata Steel, giving the inaugural address at the workshop on 'Alternative Charge Materials for Electric Arc and Induction Furnaces'

tor, NML, Jamshedpur, said, "The increasing cost of power and shortage of steel scrap have aggravated the situation. Our efforts in bringing together R&D personnel and the industry through this workshop is therefore timely". He also mentioned that NML is currently engaged in the production of sponge iron in its pilot scale VRDR furnace. It has also developed a process to produce steel directly from iron ore and has successfully used 100% DRI in induction furnaces. Dr Amit Chatterjee, Senior Technical Adviser, Tata Steel, delivered the keynote address.

The workshop had six technical sessions on problems and prospects, sources of alternative charge materials, refractory practices, melting behaviour, thermodynamics and kinetics of melting and techno-economic aspects followed by a panel discussion. Sixteen technical lectures were delivered by eminent personalities. Shri M.S. Unninayar of Steel Furnace Association of India and Shri R.P. Varshney representing All India Induction Furnace Association delivered the keynote addresses and also chaired the technical sessions. The volume of the workshop proceedings in the form of a bound book was released by Shri A. Parthasarathy, Additional Secretary, DSIR, New Delhi. The valedictory session ended with the vote of thanks by Dr A.K. Vaish, Coordinator of the workshop. □

Information Technology

A one-day seminar on 'Scenario of Information Technology in Jharia Coalfield' was held at Central Mining Research Institute (CMRI), Dhanbad. It was jointly organized by the Dhanbad Chapter of Computer Society of India (CSI) and CMRI. In his inaugural address Prof. Bharat B. Dhar, Direc-

tor, CMRI, and Chairman, CSI, said, "The whole world is now swayed by the revolutionary changes in information technology and India is no exception. But, the ripples of change are yet to touch our mining sector". He said that we should now resort to the latest technologies like cyberspace, E-mail, wireless E-mail, radio paging, LAN, etc. which are not only cheap but also reliable from the point of view of security of data.

Earlier, while welcoming the guests and participants to the seminar, Prof. D.D. Mishra, Vice-Chairman, CSI, explained the role of information technology in the present day society. Shri K.K. Rao, Secretary, CSI, explained the theme of the seminar and urged CMRI scientists to utilize the available resources of information technology in an optimal way. The vote of thanks was proposed by Dr M. Abbas, Scientist, CMRI, and Treasurer, CSI. □

World Environment Day Celebrations at CMRI

DURING the World Environment Day celebrations in Dhanbad region on 5 June 1995, which was observed in a more elaborate manner this year than the previous years, Central Mining Research Institute (CMRI), Dhanbad, took a leading role. A one-day workshop on 'Status of Miners' Health in Jharia-Raniganj Coalfields' was organized by CMRI at its auditorium. Another important programme held at CMRI was the sit-and-draw competition for children. The theme of the competition was: what do you expect the environment would be after 10 years from now?

The workshop was inaugurated by the Director General of Mines Safety, Dhanbad. In his in-

augural talk he stressed upon the need to create awareness amongst the masses about the detrimental effects of environmental degradation. In his welcome address, Prof. Bharat B. Dhar, Chairman, Organising Committee, World Environment Day (Dhanbad Region), and Director, CMRI, emphatically attributed burgeoning population growth and unplanned mushrooming of industrial units to be the main causes behind the deteriorating environmental conditions in the country. Referring to a recent CMRI study on the Health of Coal Miners in Jharia-Raniganj coalfields, he pointed out, "Though the incidences of two main diseases, namely, anaemia and helminthiasis, are on decline certain morbid conditions affecting respiratory system, skin, eyes and intestinal tract are being encountered more frequently among the mining community". As these are caused mainly due to poor quality of air and water, Prof. Dhar suggested better environmental management in Dhanbad region.

Dr. Mahabir Prasad, IAS, Deputy Commissioner of Dhanbad, went beyond the environmental problems and categorically said, "Our country is now more afflicted with some other insidious pollutions like political pollution, social pollution, economic pollution and mental pollution which are damaging the entire fabric of our nation". He then explained one by one the cancerous effects of these 'pollutants'. He also explained how they are acting as a retarding force in the development processes of the country. Prof. S.P. Banerjee, Director, Indian School of Mines, Dhanbad, said that clean air and water are the gifts of nature and these are intimately connected to health. So it is the duty of every person to stave off the continuous onslaught of man-made pollution on these basic requirements of human beings. Other important speakers on

this occasion were Shri Sudhir Rakesh, Joint Sales Tax Commissioner of Patna and Dhanbad, and Shri Rakesh Asthana, S.P (CBI), Dhanbad. Dr. T.N. Singh, Scientist 'G', CMRI, proposed a vote of thanks. □

FRP Moulding

THE third training programme in the NAL-SISI-CTD series on FRP Moulding was held recently at the National Aerospace Laboratories (NAL), Bangalore. This training scheme to nurture entrepreneurship in FRP moulding has received good response. Six participants from previous programmes have already started their FRP small scale industries, thanks to the efforts of Course Coordinator Dr R.M.V.G.K. Rao and his colleagues from NAL and elsewhere.

Dr K.N. Raju, Director, NAL, inaugurated the programme and said that the programme was transferring FRP knowhow in a well-organized manner. "FRP technology has so far been transferred on a person-to-person basis which is obviously not a very satisfactory arrangement", he remarked.

Delivering the keynote address Dr. S.R. Valluri referred to black (composite) and white (glass) futuristic aircraft and narrated the tale of how the ingenious architect built the most beautiful house out of plain bricks "when the best that the unskilled mason could build was an ugly brick house".

Shri M. Mahabala, Director, SISI, Shri C.H. H. Subramanya, Deputy Director, SISI, and Dr R.M.V.G.K. Rao also spoke briefly at the inaugural function. Shri V.V.S. Rao of NAL proposed a vote of thanks. □

New Publications of PID

Brain and Behaviour

THE human brain is a many splendoured thing. The beginning of its development goes back to antiquity—about 500 million years ago. The brain, or the mind as it is loosely called, not only monitors bodily functions and tries to keep the body out of trouble but it is also largely responsible for mental abilities and behaviour of humans. The brain functions, like other traits, are the result of the interaction of genes and environment. The cultural factors (environment) play a very significant role in our abilities to realise the potential capabilities of the human brain. All societies therefore devote large resources for developing the mental skills of their youngsters. This process of learning continues till the end.

So intricate is the functioning of the human brain that it often befuddles the best of scientific minds. The link between human

behavioural traits and the chemistry of the brain—the realm of neurons, the cellular units of the brain, neurotransmitters and certain brain chemicals, is not fully understood even today. Often the interactions between brain and body and those between brain and emotions are so intriguing that they carry us beyond the frontiers of the scientific field of neurobiology of behaviour into the rarified realms of philosophy and metaphysics.

Be that as it may, neuroscientists, brain surgeons, men of medicine and psychiatrists have over the years joined hands to understand the machinations of the brain and how it affects behaviour. They have unravelled the working of neural networks where neurons are wired together to form the basic circuits of the brain. Such networks receive information from the body, perceive the information and act upon it rationally. They have solved many mysteries and misconceptions concerning consciousness, sleep, dream, perception and that nebulous entity called the mind.

All the functions of the brain depend on the perception of the signals by the brain cells and their transmission to specific cells and tissues ultimately controlling the expression of genes. Efforts are being made to uncover the genetic basis of human talents such as mathematical skills, musical abilities, recalling of memory, etc. What makes one man a genius and another a moron? Is it all in the genes? The spectrum of emotions like love, hate, pain, anger and fear are to be understood in terms of the neural mechanisms.

Mental illnesses like schizophrenia, clinical depression, neurosis, psychosis, etc. are being studied from the viewpoint of brain biochemistry and the gene(s) responsible for the alterations and

above all failing memory with ageing. Experimental implantation of genetically engineered cells to restore the normal function of the impaired brain tissues has been successfully carried out. Gene therapy for some of the mental disorders is a distinct possibility in the future. How psychological trauma throws the brain chemistry out of gear? These and many other phenomena relating to brain and behaviour are now being studied to bring out their scientific basis. This would surely push the frontiers of neurobiological knowledge and biotechnological applications further.

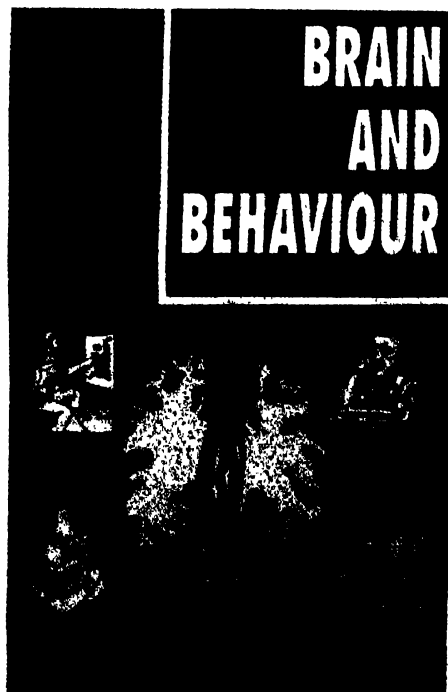
Brain and Behaviour is a profusely illustrated book that makes a concerted effort to describe almost all the aspects of the working of the human brain. And in doing so, it brings within the ambit and understanding of the layman the intricate relationship between brain and behaviour.

Authors: Sunil K. Pandya and Nikhil Shah; pp. 102, Price: Rs 20 (Paper back) + postage: Rs 2

Curable Cancer

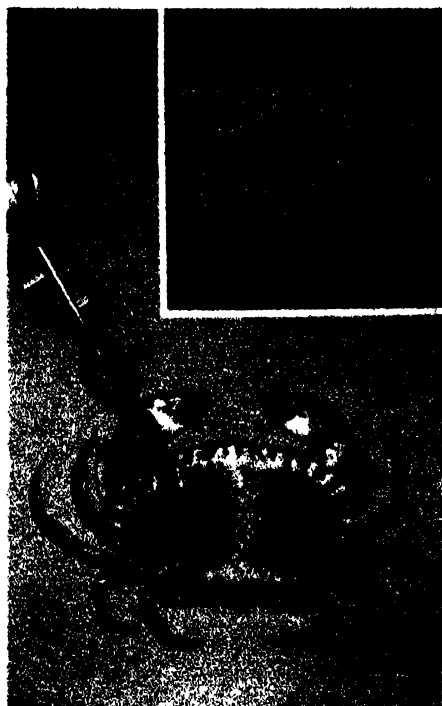
THE word 'cancer' still instills great fear in the minds of people at large and in the minds of cancer patients and their relatives in particular. There is probably no other disease more misunderstood and sinned against than cancer. The misconceptions about cancer encompass a very large canvas covering its curability at one end and its etiology at the other. The question always asked is, 'When will a magic cure be found for cancer?' To satisfactorily answer this and related questions it is necessary to know what is cancer and why it occurs.

At times human, animal and plant cells start dividing repeatedly instead of growth and differentiation that follows cell divisions in



normal tissues. This unrestrained growth of cells is known as cancer. The ancient Greeks had recognized the crab-like movement of the disease in the body and named it cancer. The disease is widespread in humans and animals. The question what makes a normal cell cancerous has not been answered as yet, in spite of intensive research in the molecular biology of cancerous cells. It is largely believed that cancer is not a single disease and different mechanisms are involved in the transformation of a normal into a cancerous cell. The underlying mechanism is the alteration in the genetic material DNA. Thus, cancer is also regarded as a malady of genes. This can be brought about by mutations which may arise due to errors in DNA-replication, exposure to radiations, and carcinogenic chemicals or tobacco smoke. Though a good mechanism to repair the genetic damage is present in living systems, at times the damage is not rectified. A single altered cell in which the regulatory mechanisms are impaired leading to uncontrolled divisions could be the origin of cancer. A number of early response genes are turned on which produce oncoproteins. Some of the oncoproteins are known to act as transcription factors and influence transcription of many other genes. Aberrant expression of nuclear oncoproteins leads to cancerous growth.

Almost undetected, cancer spreads from its site of origin to the neighbouring organs if left unchecked. Even today, cancer remains a formidable disease. However, significant milestones have been crossed in cancer research. It is today recognized as a condition of extreme cellular anarchy. Spectacular advances in diagnosis and treatment have improved the survival rates in cancer patients. Relentless research into the hows and whys of carcinogenesis has resulted in an awesome



arsenal of medical weapons against cancer. Survival rates for a disorder, once considered synonymous with death, have risen sharply over the last few decades. At the end of the 1930s, the five-year survival rate was one in five or less. Ten years later it had improved to one in four and in the mid-fifties to one in three. The improvement in survival rates is due to better awareness of the disease, early diagnosis and more effective treatment.

Cancer is curable, but prevention is better than cure and certainly many cancers are preventable. Life-style choices influence the incidence of cancer. India has the world's highest rate of oral cancer which is linked to the widespread habit of chewing tobacco. Links between smoking and lung cancer have been well established. In mice, through selective breeding, strains have been developed which consistently showed high incidence of certain types of cancers. The role of heredity in several human cancers was also suspected for a long time. Now the

specific genes for the cancer of the rectum and for breast cancer have been identified. Occupational and environmental exposure to carcinogenic chemicals should also be minimized to bring down the incidence in spite of the genetic potential.

Curable Cancer is a lucidly written and profusely illustrated book that tells us how cellular control mechanisms break down in cells which then become rebellious. It highlights the fact that many cancers may be prevented by sensible life-style choices and that, thanks to modern medicine, yet others are curable cancers.

Author: A. N. Bhisey; pp. 110.
Price: Rs 20 (paperback) + postage
Rs 2

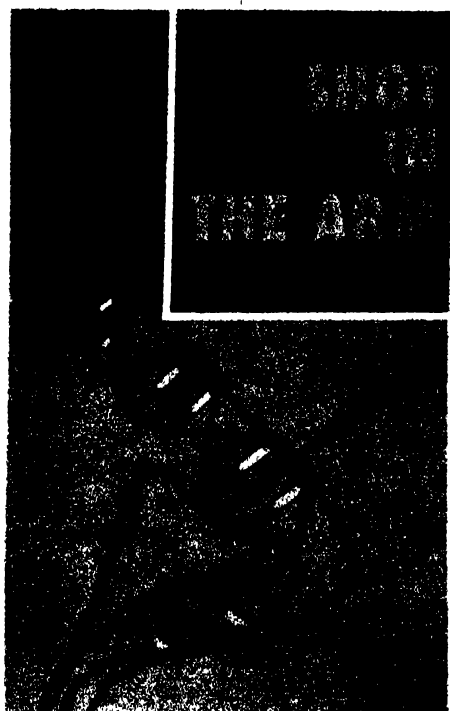
Shot in the Arm

PREVENTION of many diseases is one of the most astounding triumphs of modern medicine. Fearful scourges of the past which accounted for death or disability in millions are now under control. This is mainly due to the design and development of vaccines which have ushered in protective immunization.

Edward Jenner's observation on the immunity to smallpox enjoyed by milk maids with cowpox was indeed a breakthrough. Widespread application of vaccination against smallpox ultimately eradicated the disease in 1979.

The demonstration of the association between microorganisms and specific diseases came from the pioneering efforts of Louis Pasteur. His investigations removed the ignorance about the cause of diseases like anthrax and rabies. His painstaking work gave mankind infallible tools to fight these diseases.

With the advances in vaccinology it is now possible to control



most infectious diseases. Besides the three archetypes of protective immunization: killed vaccines, live attenuated vaccines and toxoids, a whole new generation of vaccines is on the horizon. This owes a great deal to the growing knowledge of immunology and advent of new techniques of biotechnology.

New vaccines are aimed to be safe, stable and potent. Besides, just one single shot given at birth or later can provide life-long immunity. Vaccines of tomorrow are thus poised to fulfil all the basic requisites of an ideal vaccine. In future, a single shot would provide protection against two, three or more diseases.

Moreover, there is now hope that vaccines against hitherto unconquerable diseases like malaria and leprosy would become available in not too distant future. Scientists all over the world have also geared up their efforts for designing effective vaccines to meet the challenge of AIDS. The principle of vaccination is also being extended to treat non-infectious diseases like cancers besides providing

mankind with vaccines to control birth. Both male and female fertility vaccines are being developed.

The present knowledge about various diseases and how to control them by using the powerful new vaccines bring us closer to the stated goal of the World Health Organization to achieve 'Health for all by the year 2000'.

Lucidly written and profusely illustrated, *Shot in the Arm* enlightens the reader on how new high-tech methods would help overcome hitherto unconquerable diseases by a simple yet sure shot in the arm.

Author: Bal Phondke; pp. 128, Price: Rs 25 (paperback) + postage Rs 2

The books *Brain and Behaviour*, *Curable Cancer* and *Shot in the Arm* are seventh, ninth and tenth respectively in the series of the Publications & Information Directorate's popular science monographs 'Vistas in Biotechnology' brought out under the DBT sponsored project on Dissemination of Biotechnological Information.

Orders for these books should be accompanied by Money order/I.P.O./Demand draft/cheque, made payable to 'Publications & Information Directorate, New Delhi,' and sent to: The Sales & Distribution officer, PID, Dr K. S. Krishnan Marg, New Delhi 110012. □

Doctorate

Juggnu Bhatt

SHRi Juggnu Bhatt of Central Salt & Marine Chemical Research Institute, Bhavnagar, has been awarded Ph.D. degree by the Bhavnagar University for his thesis entitled 'Modification and Sorption Studies of Clays'. Shri Bhatt did research under the guidance of

Special Techniques in Neurobiology

THE fourth workshop on 'Special Techniques in Neurobiology, Neurobiochemistry and Neurophysiology' will be held at the Indian Institute of Chemical Biology and at the Department of Biochemistry, Calcutta University, during 4-15 December, 1995. The workshop is designed to impart training to young neuroscientists, including research fellows working in universities/research institutions, and will cover the following aspects: isolation and characterization of neural cells, primary cultures, mRNA purification and assay, receptor assay, use of stereotaxic apparatus, spectrofluorimetric assay of neurohormones, HPLC-EC of neurotransmitters, movement kinematics in 3-D space, etc. Interested persons, preferably those with a permanent position, may apply through proper channel along with biodata to Dr P.K. Sarkar, Division of Neurobiology, IICB, 4, Raja S.C. Mullick Road, Calcutta 700032. Tel. 033-473-3491. Extn. 107; Fax. 033-473-0284; 033-473-5197.

The registration fee for workshop is Rs. 1500/- which includes food and accommodation. Deadline for receiving application : 6 October, 1995. Selected candidates will be intimated by 31 October, 1995. Life members of NSI can directly recommend candidates for the workshop. □

Dr V.P. Pandya, a retired Scientist of the Institute.

Shri Bhatt studied smectite clay minerals, the chief constituents of bentonite, which are naturally occurring and industrially

Centenary Memorial Symposium

LOUIS Pasteur (1822-1895) is being remembered for his remarkable contributions in science, medicine and industry. To commemorate his death centenary, Association of Microbiologists of India (AMI), Trivandrum Unit, is organizing symposium on 'Microbiological advancement in agriculture, environment, industry, medicine and veterinary science' on November 20, 1995 at Regional Research Laboratory, Trivandrum. The symposium consists of invited lectures and research paper/poster presentations.

Duly filled in registration forms should reach the convener latest by October 31, 1995 along with the registration fee of Rs. 100.00 per non-member, Rs. 75.00 per AMI member and Rs. 50.00 per student participant. Registration fee may be paid by crossed demand draft in favour of AMI payable at State Bank of Travancore, Trivandrum.

Abstract of research paper in the areas of general, agriculture, environmental, industrial, medical and veterinary microbiology should reach the convener by September 30, 1995.

For more details, write to:

Dr V.B. Mantilal, Convener,
AMI Symposium, Regional Research Laboratory, CSIR, Industrial Estate P.O., Trivandrum 695 019, Kerala; Phone: 0471-490874, Fax: 0471-490186, Telex: 0495-6232, Gram: CONSEARCH, E-mail: rrit@sinet.ernet.in.

International Society of Environmental Botanists

THE International Society of Environmental Botanists (ISEB) has been formed with its office at National Botanical Research Institute, Lucknow, to highlight the role of plants in providing bioaesthetically sound and harmonious environment. The objectives of the society are: to promote and coordinate research on plants in relation to environmental pollution; to encourage better interaction among researchers, teachers and social activists and to create awareness among masses, policy makers of the Government and leaders of the industry, with active cooperation of NGOs and the media. The society has since brought out the first issue of its quarterly newsletter. □

useful materials. They possess adsorption properties with tendency to adsorb organic and inorganic species. However, if they are methodically modified they can be tailor-made as adsorbents for a given application. In the present studies, efforts were initiated to search for montmorillonite-rich Indian bentonite clay which could be modified so that organo-clay complexes required as adsorbents in industries could be prepared. □

Deputation Brief

P. Natarajan

PROF. P. Natarajan, Director, Central Salt and Marine Chemicals Research Institute (CSMCRI), Bhavnagar, was invited to deliver a lecture and chair a session at the

11th International Symposium on the 'Photochemistry and photo-physics of coordination compounds' held at Faculty of Chemistry, Jagiellonian University, Krakow. He visited Poland during 7 to 21 July 1995 under the CSIR-INSA Exchange programme. He took the opportunity of this Polish visit to interact with scientists of Institute of Physical Chemistry (IPC) of the Polish Academy of Sciences, Warszawa, where he delivered a lecture on 'Redox photochemistry of transition metal complexes and its applications in catalysis and new materials'. His visit enabled him to meet stalwarts in the field like Prof. Jacek Waluk and Prof. Jerzy Herbich at Institute of Physical Chemistry. The Institute of Physical Chemistry was founded by eminent scientist Prof. Z.R. Grabowski. With a strength of 200 scientist and 17 departments, IPC has become an organization to be reckoned with. Prof. Natarajan has persuaded the organizers to hold the 14th symposium in this series in India which they have agreed. Plans are afoot to invite some of the Polish scientists to CSMCRI to participate in the ensu-



Prof. P. Natarajan, Director, CSMCRI, Bhavnagar, discussing a point during a colloquium in Poland

R & D Flash

Rigid Steel Prop with Remote Release Mechanism developed

CENTRAL Mining Research Institute, Dhanbad, has developed a rigid steel prop with remote release mechanism for supporting mine and tunnel roofs. The release of conventional steel rigid prop is difficult and sometimes impossible particularly when the load on the prop under installed condition is quite high. Moreover, when the roof condition is adverse, withdraw of the prop from a close vicinity is unsafe and may cause fatal accident. This development would not only ensure safety to the workers but also enable repeated use of the prop cutting down the expenditure on this account. The patent has been filed for this prop. (For photo : see cover). □

ing workshop on 'Catalysis' proposed to be held here in December this year. □

Honours & Awards

Harsh K. Gupta

DR Harsh K. Gupta, Director, National Geophysical Research Institute, Hyderabad, has been unanimously nominated as Acting President of the newly constituted Asian Seismological Commission (ASC) at a meeting held at Guanzhou, China. The meeting was attended by representatives from International Union of Geodesy and Geophysics (IUGG), SSB and members from Asia and Southern Pacific region countries. ASC will

serve as a platform for interaction among the member countries to mitigate earthquake hazards. Dr Gupta has also been elected as Vice President of International Association of Seismology and Physics of the Earth's Interior (IASPEI) for the period 1995-99. He is the first Indian to be elected to this highly



prestigious post. Earlier, he was the member of the IASPEI executive committee. Dr Gupta has carried out extensive research in the field of seismology and earthquake studies. He is also the recipient of several national awards and honours.

Prof. Bharat B. Dhar, Director, Central Mining Research Institute, Dhanbad, has been awarded the prestigious Dewan Bahadur D.D. Thacker Coal Gold Medal for the year 1994-95 given by Mining, Geological & Metallurgical Institute of India (MGMI) in recognition of his outstanding contributions to the coal mining technology.

Prof. Dhar has over 120 scientific and technical papers to his credit and has edited four books. He is the Editor-in-Chief, *Journal of Mining Research* (JMR), and is on the Editorial Board of several journals published from India and abroad.



Today, he is an accredited expert in the field of environmental management of mining operations in India and is well recognized as an Environmental Consultant Scientist by United Nations and UNEP, UNCTED, World Bank, etc.

Earlier, Prof. Dhar was President of Mining, Geological and Metallurgical Institute of India (1994-95). At present, he is the Chairman, Institution of Engineers (India), Dhanbad Local Centre, 1994-96, and is an important member in a number of technical and scientific committees in India. □

NAL Software functional

THE PC-based software in MATLAB for parameter identification of flight measured data developed by Dr J.R. Raol, Shri V. Parameswaran and their colleagues of the Flight Mechanics and Control Division (FMCD), National Aerospace Laboratories (NAL), Bangalore, is now fully functional at the Experimental Flight Test School (EFTS), ASTE, Air Force. The software will shortly be integrated with the training curriculum of the School's fixed wing flight test course. In a letter addressed to Head, FMCD, Gp Capt G.R. Mohan, OC, EFTS, writes that the NAL software development effort is "praiseworthy". □

Printed and Published by Dr G.P. Phondke, Director, Publications & Information Directorate (PID), Dr K.S. Krishnan Marg, New Delhi - 110 012

Printed at PID Printing Unit

Editors : Dr B.C. Kashyap, Dilip M. Salvi and Madhu Sahni

Production : Kamal Kishore

Annual Subscription : Rs. 60

Single Copy: Rs. 3.00

Phone: 5786301

Gram: PUBLIFORM

Telex: 031-77271

E-mail: pid@simetd.ernet.in

Fax: 5787062

CSIR


VOL 45 NO 18 30 SEPTEMBER 1995

IN THIS ISSUE

Central Drug Research Institute, Lucknow, R&D Highlights : 1994-95	274
Bimetal Ring handed over to TIFR.	275
CECRI turns Forty-seven	279
Data Processing for CD- ROM Publishing	283
UN Award for CGCRI Invention	288
CSIR Divisions renamed	288

CSIR Young Scientist Awards presented

THE country's most coveted S&T Prize — S.S.Bhatnagar Prize— for the year 1995 was announced by Dr R.A. Mashelkar, D.G. CSIR, at a glittering function held at NPL Auditorium, New Delhi, on 26 September 1995, the CSIR Foundation Day (See box for Prize winners). On this occasion, the CSIR Technology Awards were also announced. The CSIR Young Scientist Awards were presented to the recipients by Shri Bhuvnesh Chaturvedi, Minister of State for S&T, Government of India. Earlier, Dr S.K. Joshi, Ex-DG, CSIR, delivered the Ninth CSIR Foundation Day Lecture titled 'CSIR-Vision 2010' (For details: next issue). □

1995 S.S. Bhatnagar Prize winners

Mathematical Sciences: Dr Rajendra Bhatia of Indian Statistical Institute, New Delhi; **Physical Sciences:** Dr Mustansir Barma of Tata Institute of Fundamental Research, Bombay, and Dr B. Sri-ram Shastry of Indian Institute of Science, Bangalore; **Chemical Sciences:** Dr J. Chandrasekhar of Indian Institute of Science, Bangalore, and Dr K.L. Sebastian of Cochin University of Science & Technology, Cochin; **Biological Sciences:** Dr S.E. Hasnain of National Institute of Immunology, New Delhi, and Dr K. Muthyappa of Indian Institute of Science, Bangalore; **Earth, Atmosphere, Ocean & Planetary Sciences:** Dr B.N. Goswami of Indian Institute of Science, Bangalore; **Engineering Sciences:** Dr Kamanto Chattopadhyay of Indian Institute of Science, Bangalore; **Medical Sciences:** Dr Subrat Kumar Panda of All India Institute of Medical Sciences, New Delhi, and Dr Anil K. Tyagi of Delhi University, New Delhi. □



The CSIR Young Scientist Award-winners with the Minister of State for S&T, Shri Bhuvnesh Chaturvedi, Dr S.K. Joshi, Ex-DG CSIR and Dr R.A. Mashelkar, DG CSIR

Central Drug Research Institute, Lucknow

R & D Highlights : 1994-95

THE year 1994-95 saw the beginning of an era of changed national and international scenario in new drug development—an era calling upon the nation to build competence in this field to face the challenge of international competition. The changed scenario is the outcome of India signing GATT, and as a result international Intellectual Property Right (IPR) became effective in India from January 1995.

In the past, Central Drug Research Institute (CDRI), Lucknow, has played the role of a leader in new

drug development in India. With several large drug companies launching their own R&D programmes for drug development in recent times, CDRI now looks forward to a greater responsibility by way of sharing its expertise and human resource and joining hands with the industry to accelerate the pace of new drug development in the country.

In its pursuits for interaction with the drug industry, the institute has therefore redefined its various long-term projects and evolved clearly focussed and time-targeted R&D

programmes directed towards product/technology development. The industry has in turn responded to this change. The institute has now closer interaction with the industry. The latter's involvement in institute's R&D programme is from early stages of drug/technology development. The institute has signed several collaborative-cum-licensing agreements with the industry.

During the year 1994-95, the institute's R & D programme continued to be directed towards development of drugs in national priority health care areas, namely, fertility control, malaria, filariasis, leishmaniasis or kala-azar, and some cardiovascular and nervous system disorders as well as in internationally competitive areas such as liver disorders, wound healing, osteoporosis and fungi infections.

In the year under review, the institute has made progress on all fronts. Some significant developments are given below:

Industry-oriented R&D Programme

Significant linkages established with the drug industry are: (i) Licensing of new drug Chandonium iodide (neuromuscular blocking agent) to CIPLA Ltd., Bombay, for marketing; (ii) Collaborative-cum-licensing agreements with Themis Chemicals Ltd., Unichem Laboratories Ltd., and Piramal Nicholas India Ltd., Bombay; (iii) Long-term collaborative project with Core Parenterals Ltd., Ahmedabad; (iv) Licensing of technology for Acyclovir to Ranbaxy Laboratories Ltd., New Delhi; (v) Projects spon-

R&D Flash

Multipurpose Trolleys for LCA wings handed over to CFC Wing National Team

ON 1 September 1995, two multipurpose trolleys for the LCA wings were handed over to the CFC Wing National Team. The trolleys developed by the Engineering Services Division (ESD) of National Aerospace Laboratories, (NAL), Bangalore, were received by Dr J.M. Debnath, GM (ADB), HAL. It was a particularly proud moment for Shri K. Venkatachalam, Shri C. Chandrashekar and other colleagues of ESD who had worked very hard to complete the project.

The overall dimensions of the trolley are 2500 x 2400 x 1200 mm; its capacity is 1.25 tonnes. Two trolleys for the LH and RH wings were handed over. Some of the salient features of the trolleys, which will allow the wing to be tilted from

-10° to 70°, are: pressure testing of the wing fuel tank, hydraulic function check for jacks of slats, elevons, movement of wing inside the assembly area, foil application on top and bottom of wing, painting of wing and fixing of fairings, shrouds, etc.

Speaking briefly at the function, Dr Debnath said that the trolleys constituted a "good collaborative effort". Dr B.R. Somashekar said that 1995 was a "year of handing over" for NAL and expressed his happiness at the new work culture evolving at NAL. And Dr S.R. Valfuri, while congratulating the teams involved, remarked, "I started the LCA project; I can't wait to see the war-plane fly!"

R&D Flash

sored by Tata Ltd., Calcutta, CIPLA Ltd., Bombay and IDPL, New Delhi. The institute continued to supply its compounds/plant extracts for testing to DuPont De Nemours & Co, and National Cancer Institute, USA, and LVMH, France, under agreements signed earlier.

The institute has also signed several secret agreements with industry, viz., Zymogenetics, USA; Laboratories Silesia SA, Chile; a South African firm; and Khandelwal Laboratories Ltd., Bombay, for sharing data on various products. Confidentiality agreements have also been signed with WHO Tropical Diseases Research Programme. Besides, the institute has negotiated terms for transfer of technology/licensing agreements with several other companies, some of these are about to be finalized.

Sponsored Research

The institute continued on-going research projects and initiated new ones supported through grant-in-aid or sponsored by national/international agencies. The national agencies which supported R&D and other programmes at the institute are MOH, DST, DSIR, DBT, DOD, ICMR, NRDC, UP CST. Among the international/foreign agencies which supported research programmes at the institute are: Centre for Vaccine Development, Maryland; National Cancer Institute and Uniformed Services University of Health Sciences, Bethesda; Walter Reed Army Institute of Research, Washington, USA; Borstel Research Institute, Germany; Institute of Biochemistry and Physiology of Microorganisms, Russia; and World Health Organization, Geneva.

During the year 1994-95, the Extra Budgetary Resources generated

through the licensing of technology, royalty and premia and contract research are estimated to reach Rs 66.8 million which amounts to 41.5% of the institute's total budget of Rs 161 million.

R & D Programmes

Primary Biological Screening. The institute screened 628 new synthetic compounds, 75 terrestrial plant extracts and 207 marine samples, including those received from academia. About 157 marine samples were received from institutions collaborating under the Department

of Ocean Development (DOD) sponsored national project 'Development of Potential Drugs from the Ocean' coordinated by CDRI.

Samples which showed significant biological activity are as follows: 5 synthetic compounds, 8 plant extracts and 8 marine samples showed anti-implantation activity; 3 synthetic compounds had spermicidal activity; 7 synthetic compounds and 1 marine sample showed antifilarial activity; 4 synthetic compounds had anti-malarial activity; 1 synthetic compound, 2 plant extracts and 8 marine samples

NAL-ADA-TIFAC Agreement to develop Prepregs

ON 24 August 1995, the officials of National Aerospace Laboratories, Bangalore, (NAL), TIFAC and ADA put their signatures on an agreement to develop aircraft grade thermoset prepregs within 24 months. At present, no one in India makes prepregs; they are all imported; a typical aircraft grade carbon prepreg costing as much as Rs 4800 per kg. The NAL-ADA-TIFAC agreement now stipulates that with funding from ADA and TIFAC, and a generous offer from DRDL, NAL will deliver the prepreg fabrication technology. IPCL, Baroda, is likely to manufacture and sell these prepregs in India.

A prepreg is a pre-impregnated (with resin) unidirectional fibre tape (with a thickness typically of about 0.15 mm) which is the 'building block' for making a composite product or component. Depending on the application one could use carbon fibre (e.g., for aircraft wings) or glass fibre (e.g., for printed circuit boards) prepregs. Based on a pre-determined stacking sequence, layers of prepregs are placed one on top of the other and eventually cured in an autoclave to obtain the desired composite product. By tailoring the chemistry of the impregnated resin, it is possible to build in specialized properties such as temperature stability or electrical resistivity in the prepreg.

The agreement signing function opened with a brief welcome by Dr B.R. Somashekar. He remarked that "this important project will open the doors to composite technology in the country". It was followed by technical briefs from Shri M. Sridhar of NAL and Shri P.D. Mangalagiri of ADA, and remarks by Dr N.S.Venkataraman of TIFAC, Prof K. Rajaiah of ADE and Shri S.A. Hussainy.

After formally receiving the agreement papers from Dr Venkataraman, Dr K.N. Raju, Director, NAL, expressed his happiness that a long awaited event had finally taken place.

Speaking about the prepreg project, Dr Kota, Head, LCA Project, said that it was very important to indigenise the prepreg technology "so that the LCA programme is not choked". Dr Kota also advised the project team to hold a review every month, with alternate reviews at IPCL "so that the association is fruitfully nurtured".

The function closed with the vote of thanks by Dr A.K. Singh. He recalled that NAL's first proposal on prepregs was made nearly ten years ago and expressed his happiness that the Material Science Division's dogged perseverance has finally paid off. □

New Drug Development

Fertility Regulation/Anti-breast Cancer

- Consap (local contraceptive cream) : It was granted clearance by the the Drug Controller (India) for conducting Phase III clinical trials.
- Centchroman (anti-breast cancer) : Phase III clinical trials continued at 8 centres. The trial results showed improvement in condition/partial response/stable disease in about 57 % cases.

Parasitic Diseases

The institute continued with its programme for development of drugs for parasitic infections, viz. malaria, filariasis and leishmaniasis (kala-azar). Drugs under development in these areas made significant progress.

- Arteether (blood schizontocidal anti-malarial) : Phase II clinical trial data were submitted to the DC(I) and permission for phase III clinical trial has been received. The Phase II trials clearly established the efficacy of parenteral administration of Arteether against uncomplicated *Plasmodium falciparum* malaria.
- Compound 80/53 (anti-relapse anti-malarial): Phase II clinical trial (double blind, non-cross over) was carried out on 649 patients suffering from *P.vivax* malaria. So far, only 79 out of 649 cases have shown relapse.
- Compound 87/209 (resistance modulator): Parasitaemia was cleared when this compound was administered concurrently with chloroquine to mastomys or mice infected with chloroquine resistant *P. berghei* and to mice infected with multi-drug resistant *P. yoelii nigeriensis*.

showed anti-viral activity; 2 synthetic compounds, 3 plant extracts and 7 marine samples were anti-microbial; 6 synthetic compounds and 3 marine samples were hepatoprotective; 4 synthetic compounds showed anti-ulcer activity; 4 syn-

thetic compounds had anti-PCA activity; 2 compounds, 5 plant extracts and 4 marine samples showed hypoglycaemic activity; 2 marine samples showed hypolipidaemic activity; and 3 marine samples showed oxytocic activity.

- Compounds 93/123 and 166 (blood schizontocides): Its efficacy has been confirmed against multidrug resistant *P. yoelii nigeriensis* in Swiss mice.
- Centperazine (anti-filarial): Phase II pilot clinical study carried out in 22 microfilariae positive cases in a village near Lucknow has shown the drug to be well tolerated. Sustained fall in microfilariae count in the drug treated cases suggests its sterilizing effect on adult worms. The drug was also found to be devoid of side effects.
- Compound 81/470 (broad spectrum anthelmintic): Multicentric veterinary trial has shown excellent results and the study is continued in poultry and ruminants.
- Compound 92/187 (anti-leishmanial): Its activity has been confirmed in repeat tests in animals.
- Initiated at K.G.'s Medical College, Lucknow, and Seth G.S. Medical College, Bombay.
- Picroliv (hepatoprotective): Phase II clinical trial conducted in 14 cases of acute severe viral hepatitis at Department of Medicine, K.G.'s Medical College, Lucknow, was completed. It showed good results.
- Bacosides A & B memory and learning: Phase I single dose clinical trial completed in 31 human volunteers has revealed it to be safe. Multiple dose study has been initiated in eight cases.
- Bacosides A & B produced significant attenuation of scopolamine induced amnesia by improving both acquisition and retention activities in rat.
- On detailed evaluation, compound 92/213 showed potent hepatoprotective and compounds 93/258 and 94/284 potent anti-ulcer activity in various *in vivo* and *in vitro* models.

Drugs for CVS, CNS and Other Disorders

- Chandonium iodide (neuromuscular blocking agent): DC(I) permission received for its marketing.
- Centpropazine (anti-depressant): Phase III clinical trials carried out in four centres compared its efficacy with imipramine, a common drug for depression. A comparison of data for centpropazine and imipramine by using three scales for the evaluation of their efficacy, viz., Hamilton Depression Rating Scale (HDRS), Asberg Side Effect Scale (ASES) and Clinical Global Impression Scale (CGIS), has revealed that Centpropazine's anti-depressant efficacy was comparable with that of imipramine. ASES clearly demonstrated that Centpropazine has less incidence of side-effects as compared to imipramine.
- Compound 80/574 (hypolipidaemic): DC(I) permission was received for conducting phase II clinical trial. The trial has been in-

Drugs from Natural Products

Extracts/fractions derived from terrestrial plants, marine flora and fauna that showed promising activity were evaluated for confirmation of activity/drug development:

- Plant 62 (anti-asthmatic): Anti-PCA and mast cell-stabilizing activities were confirmed in hot aqueous extract and subsequent chromatographic fractions, F079 and F080 as well as in fractions F071, F073 and F075 of the hexane extract.
- Plant 36 (anti-asthmatic): A sesquiterpene alcohol, K040, isolated from the wood of the tree showed significant anti-PCA activity. Compound K040 also showed moderate activity against systemic aspergillosis in mice.
- Plant 3234 (anti-filarial): The reduced product F060, derived after hydrogenation of active glycoside fraction F059, showed 60% macrofilaricidal action against *Brugia malayi* infection in mastomys. Of the surviving females, 90% were sterilized.
- Plant 3664 (anti-urolithiatic): Aqueous extract and its fractions showed reduction in urinary oxalate and calcium contents in rat model.
- Plant 74 (wound-healing): Significant activity was observed in the crude extract and the saponin mixture.
- Plant 380 (memory and learning): Bacoside B was isolated in pure form by normal and reverse phase chromatography. Its aglycone has been characterized as pseudojubogenin and sugar as arabinose.
- Plant 1929 (adaptogenic): Activity was confirmed in ethanolic extract by swimming stress, immobilization and cold stress tests in rats.
- CDR 110 (anti-viral): A new ceramide isolated and characterized was found to be inactive. It is the first reported Δ^6 -sphingosine derivative from a natural source.
- CDR 50 (anti-viral, diuretic): Diuretic activity was localized in methanol fraction F026 which contains amino compounds, one of them has been isolated and identified as taurine.
- CDR 132 (anti-oxytocic): Batyl alcohol (K018) isolated showed anti-oxytocic activity while two diterpenes of cembrane series exhibited oxytocic activity.
- CDR 134 (anti-diabetic, larvicidal): Fractions F007 and F009 showed significant blood lowering activity. Chloroform soluble fraction F006 was larvicidal against *Culex quinquefasciatus*.

Bioactive Peptides

- Compound 82/205 (immunomodulator) : Subacute toxicity

studies in rats and monkeys have been completed.

- Compound 91/409: A hexapeptide structurally related to human casein fragment (54-59) has been found to be potent immunostimulant in mouse/SRBC model.

Immunomodulation Vaccine Development/Immunodiagnosis

- *M. habana* anti-leprosy vaccine: DC(I) permission was received for conducting Phase I clinical trials.
- *P. cynomolgi* anti-sporozoite monoclonal antibodies cross react with early EE stages, while late EE stages cross react with anti-merozoite antibodies. Three parasite LDH specific epitopes have been identified using monoclonal antibodies.
- Antigen spot test developed by using monoclonal antibodies was evaluated on serum samples collected from kala-azar endemic area of Muzaffarpur (Bihar). The cases found negative in AST were also negative for the parasite.
- Two new monoclonal antibodies (SC 2 and SC 8) with high specificity to antigenic epitopes other than those of SC 1 have been identified for development of antigen based diagnostic test for filariasis.
- Interferon inducer Poly IC:LC when given to hamster with 1-arginine gave 75-80% protection against *L. donovani* infection.
- The 23 kD protein of *M. habana* terminally sequenced and probed with monoclonal antibodies was identified as superoxide dismutase (SOD).
- The 33 and 53 kD antigens of O1 cholera strain provided protection up to ten months. Analysis of *V. cholerae* mutant T-87 clone revealed that 53 kD antigen was coordinately expressed with Ompu and TcpA antigens.

Development of Test Systems

- A test system utilizing primary cultures of rat Sertoli cells has been standardized for screening of anti-spermatogenic compounds *in vitro*.
- A microculture technique using chloroquine sensitive strain of *P. falciparum* has been developed for quick screening of potential blood schizontocides.

Technology Development

- Sulbactam technology was developed at bench scale by using 6APA; the overall yield being 64.6%.
- Leuprolide has been synthesized by using Boc and Fmoc technology with final product of 95-97% purity.
- Buserelin has been synthesized by fragment condensation. SCn RH-A has been synthesized by fragment condensation in solution phase using chemical and enzymatic coupling methods.
- The institute extended its facility for custom synthesis of peptides to the academia and industry on a nominal fee.
- An efficient method of synthesis was developed for mixed succinimidyl carbonates, commonly used for alkoxycarbonylation of amino acids. For obtaining carbonates from primary/secondary/tertiary alcohol, the exclusive reagent used was N,N-disuccinimidyl carbonate.
- A novel single-strip test paper kit was developed for quality control of iodized salt. The kit does not require distilled water in field conditions; 100 such kits have been supplied to PTC, Bhopal, for field trials in M.P.
- About 150 kg of Biocide formulation comprising *Bacillus sphaericus* and *Bacillus thuringiensis* mixture was produced and supplied for testing. The Biocide satisfactorily completed

safety (irritancy) tests on skin and mucous membrane in animals.

- The process for L-lysine was scaled up to 150 L fermenter using molasses medium with yield of 48 g/l in 48 hr; conversion efficacy was 46% based on sugar consumed.
- Active fraction of the antibiotic BMA-19 isolated from bacteria showed potent antibiotic activity (MIC: 0.04875 µg/ml).
- Lactic acid production was standardized in shake flasks using *Rhizopus arrhizus*. Studies with hydrolyzed starch yielded 80-85% lactic acid.

Publications and Patents

The institute published 154 research papers in national and international journals and contributed 56 chapters in three edited/published books and filed nine patents.

Support Activities and Technical Services

The institute's national level facilities, viz, National Laboratory Animal Centre (NLAC), Regional Sophisticated Instrumentation Centre (RSIC), National Information Centre for Drugs & Pharmaceuticals (NICDAP), extended service to the outside users/institutions as well as to the institute's R&D programme. For the outside institutions, NLAC supplied germ-free, specific pathogen-free and standard laboratory animals, RSIC carried out physicochemical analysis of samples of received pathogens, NICDAP provided MEDLINE literature search, current awareness publications and reprographic service. In addition, the institute extended facilities for regulatory toxicity testing, biological screening and hormone assay. □



CECRI turns Forty-seven

THE Central Electrochemical Research Institute (CECRI), Karaikudi, celebrated its 47th Foundation day on 25 July, 1995. Dr Gudrun Vogel, Consul General of Germany, Madras, delivered the inaugural address. Dr Umayal Ramathan, Alagappa Educational Trust, Karaikudi, declared open a conference room at CECRI. Prof. P. Ramasamy, Vice Chancellor, Alagappa University, released brochures on CECRI technologies. Shri K.G. Ramani, an industrialist from Madras, and Thavathiru Ponnambala Desikar Swamikal of Kundrakudi were among the dignitaries who extended their felicitations on this occasion. But the main highlight of the day's proceedings was the Foundation Day lecture delivered by Padma Vibhushan Prof. C.N.R. Rao, a scientist of universal acclaim.

Prof. G.V. Subba Rao, Director, CECRI, who presided over the function, dealt at length with the status of CECRI as a major institution for electrochemical science and technology in the Asian region. He said that the history of CECRI was the history of electrochemistry in India. During the

year 1994-95, CECRI completed 18 sponsored/grant-in-aid projects valued at Rs 14 million. In addition to the 18 on-going projects (valued at Rs 4.5 million), CECRI has taken up 22 new ones valued at Rs 8.8 million. The year also saw completion of four consultancy assignments worth Rs 0.5 million. CECRI hopes to earn Rs 0.2 million as royalties during 1994-95. Of the laboratory reserves of Rs. 3.5 million, CECRI has used 90% for improving its infrastructural facilities.

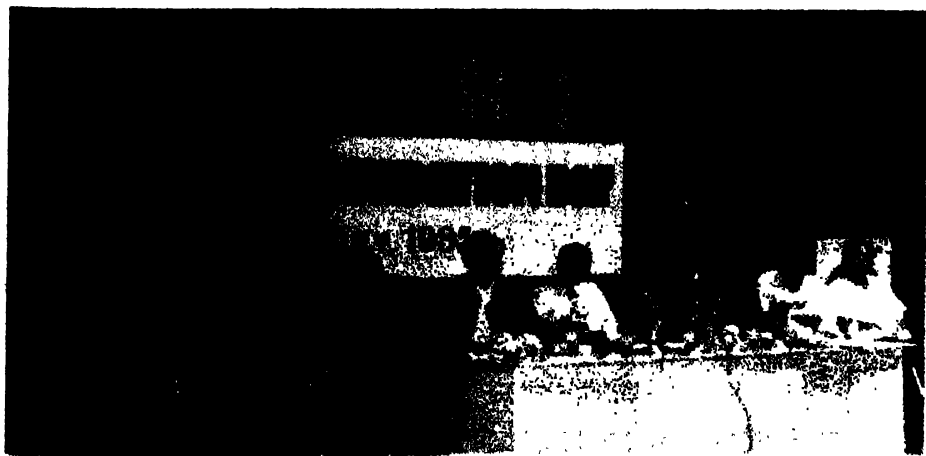
Prof. Subba Rao said that during 1994-95, CECRI scientists published 143 research papers and presented 40 papers at various national and international fora. CECRI organized/co-sponsored nine conferences/symposia. It deputed 168 of its personnel for the conferences/symposia within the country and 11 scientists abroad for short or long term scientific programmes. The year also saw nine scientists completing their Ph.Ds.

The major activities undertaken by CECRI this year include development of membrane cell technology for the production of sodium hydrox-

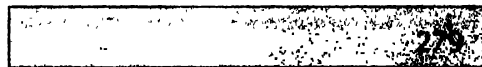
ide and potassium hydroxide, setting up of a plant at NALCO for the manufacture of gallium, electrolytic production of aluminium at low operating temperatures, installation of a cathodic protection and monitoring system at the Madras Port Trust, electroforming of copper and nickel for the thrust chamber of cryogenic engines, and development of sensors.

In his Foundation Day lecture, Prof. C.N.R. Rao, President, Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore, said that doing science was not an occupation but a wonderful way of living. But scientists today witness a major change. Scientists in India, who have all along been oblivious to the outside world, thanks to a centrally protected economy that can neither be called a complete failure nor a complete success, are today suddenly faced with an unenviable task of competing with the best in the world. "Competitiveness" has become the byword today.

What does competitiveness mean? Before we seek an answer to this question, continued Prof. Rao, it is pertinent to analyse the scenarios elsewhere. The Soviet Academy of Sciences was a very powerful organ in the erstwhile Soviet Union dictating policy issues to the Government which in turn vouched for every action of the Academy. The members of the Academy enjoyed special scientific and personal privileges. After the break-up of the Soviet Union, the Russian economy in the garment of liberalization has undergone a sea change. In a state where five years ago science ruled supreme, the Russian Academy of Sciences is today struggling to provide salary to its members. With the rouble plummeting to as low as 5000 and odd roubles per dollar, Russian scientists earn a paltry \$ 75 per month! The Hun-



Dr C.N.R. Rao delivering the CECRI Foundation Day lecture



garian Academy of Sciences, based on an assessment of the performance of institutes managed by it, is soon expected to get rid of 40-50% of its scientists!

Prof. Rao then dwelt with the scenario outside the former Eastern Bloc. The scenario appears no different. As an illustration he took the case of CSIR of South Africa which was an excellent organization some ten years ago. Today, there is hardly any CSIR left! People at the helm of affairs went on changing objectives of CSIR so fast that good science suffered and good technology ceased to emerge; 90% of its good scientists have left for greener pastures abroad and what is left is a poor skeleton, said Prof. Rao.

Taiwan, however, is an example in contrast, continued Prof. Rao. Taiwan at the end of the Second World War was a poor country that relied on cottage industries which produced clothes and shoes. A cooperative movement then gathered momentum there. The poor weavers and artisans saved every bit they could and poured their money into electronics industry. Every one of them is today a rich man, a shareholder. Taiwan's per capita income is today as high as that of the US! In India, if a cut in budget is warranted, continued Prof. Rao, the first casualties would be science and education. On the other hand, for the Japanese a decrease in foreign trade surplus could mean a recession but science and education are an investment. According to Prof. Nagakura of the Japanese Academy, recession is a time to think — a time to invest in science and technology.

So, what does competitiveness mean? Compete with the US and Japan? Prof. Rao said that India is faced with special social issues: we

have to feed our poor millions and do science and technology simultaneously. In the year 2000, India's food requirements would be a whopping 250 million tonnes! Now if private industries take over, the Government would have little control over industrial development. However, health, education and science would still be controlled by the Government. The Government could, however, bring science outside its control. But, apart from the Government, there is no source for capital investment. So, the Government must protect the scientists for about 5 to 10 years. Meanwhile competitive science must be done.

According to Prof. Rao, two or three areas should be identified. Should we compete in technology? Should our technology be as good as of others? Israel, a desert country, for example, makes the best aviation electronic equipment. Therefore, for the survival of institutes like CECRI, major policy changes must be ef-

fective. An area that comes to mind immediately and which is of relevance to CECRI is the area of sensors, he added. 99.9% of sensors in US today are of Japanese origin. The Japanese even have sensors to examine whether a fruit is ripe or not! But the Japanese don't make sensors for their own use; they make them for US market. Sensors provide the Japanese a low cost/low investment business with high returns. Another promising area is the software business. India's capability in producing software is acknowledged to be among the best in the world. However, our share in the world's technical software business is hardly 0.1%. We scientists should therefore become business-minded, Prof. Rao emphasized.

Earlier, Dr G. Prabhakara Rao, Deputy Director, CECRI, welcomed the gathering. Dr A.S. Lakshmanan, Scientist, CECRI, proposed a vote of thanks. □

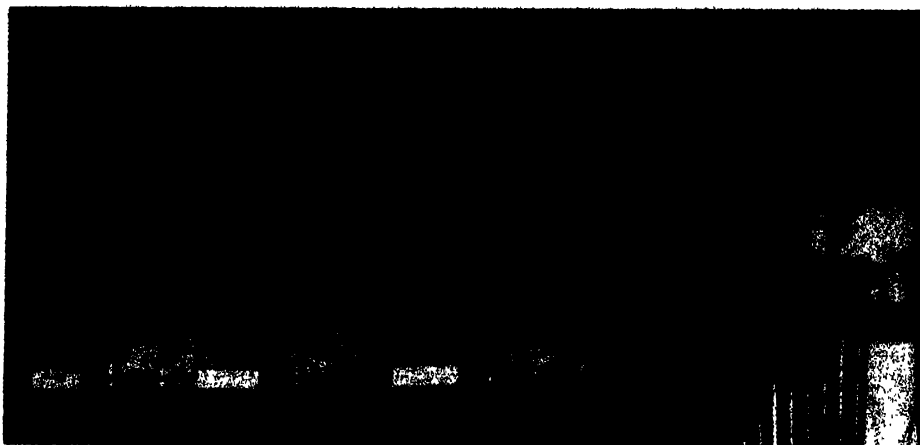
CMRI Foundation Day Lecture

WHILE delivering the Foundation Day Lecture on 10 May 1995 in the auditorium of Central Mining Research Institute (CMRI), Dhanbad, Shri Mahip Singh, former CMD of MECL, CMPDIL and NLC, advocated intermediate technology for coal industry. The lecture was organized as a part of the Foundation Day celebrations of the institute. "Thirty per cent of the Indian population lives below the poverty line. So, a poor country like ours cannot afford to spend millions of rupees in importing sophisticated technology from developed countries," said Shri Singh, who was also the Chief Guest on the occasion, "Moreover, such technologies do not

produce good results here because of inadequate trained personnel, non-availability of spare parts, among other things".

Intermediate technology would pay better dividends at a slower pace, he said. He exhorted CMRI scientists to prove their ability by developing suitable intermediate technologies which would be appropriate for Indian conditions. He also touched upon some of the important issues related to mining which directly affect the poor people and urged CMRI scientists to tackle them.

Dr K.S. Narasimhan, Director, Central Fuel Research Institute, Dhanbad, and the Guest of Honour



Shri Mahip Singh, the Chief Guest, delivering the CMRI Foundation Day lecture

on the occasion, appreciated CMRI for its contributions in the field of mining. Earlier, Prof. Bharat B. Dhar, Director, CMRI, welcomed the guests and participants. He also traced the history of CMRI and spelt out how CMRI has been diversifying its activities with the changing scenario of the mining industry as well as the open-door policy of the Government of India. He also presented a CMRI memento to the Chief Guest,

and Dr. S.C. Srivastava, Scientist F, CMRI, proposed a vote of thanks. After the function, Shri Singh paid a visit to different laboratories of the institute. In the afternoon, he also met senior scientists and discussed with them various present-day problems of the mining industry and how to improve the quality of life of mine-workers inside as well as outside the mining environment. □

Institute - Industry Meet on Non-Oxide Ceramics

THE Central Glass & Ceramics Research Institute (CGCRI), Calcutta, held the 'Institute-Industry Meet on Non-oxide Ceramics in Refractory and Engineering Applications' on 25 April 1995 at Atma Ram Committee Room of the institute. This was the Fifth in the series of Institute-Industry meet organized by CGCRI and the first of its kind this year.

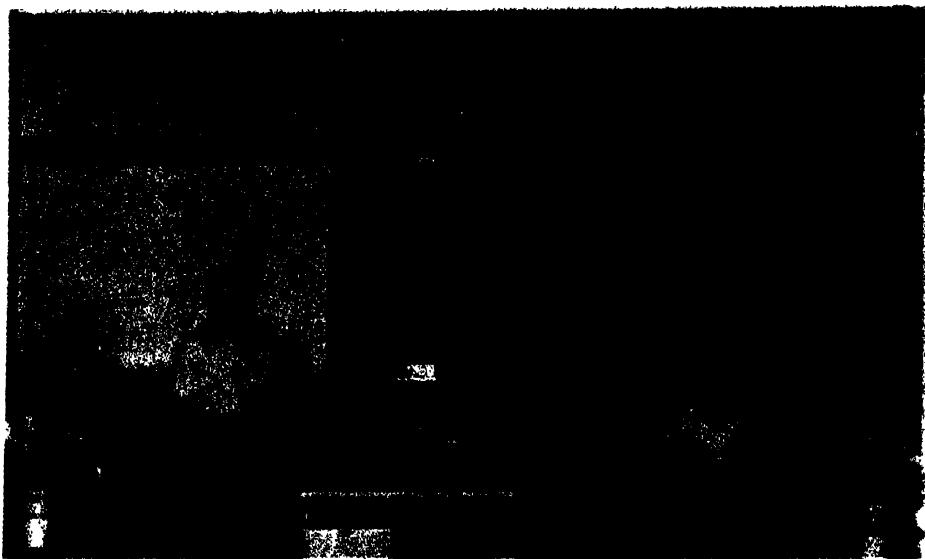
Well recognized as a new generation of engineering materials, advanced ceramics are mostly composed of non-oxide ingredients and are recognized for their superior qualities. They are capable of with-

standing high temperatures, especially in non-oxidizing atmosphere, and possess properties such as hardness, good mechanical strength, etc. It appears that these materials may serve as alternative to metals. Hence their use in turbines, steel plant refractories, furnace and crucible liners, automotive and air craft engine, machine tools, electronics, etc., holds out promise. Non-oxide ceramics are identified as carbides, nitrides, borides, etc. A renewed thrust has nowadays been given to the R&D projects of the institute in this area. From synthesis of powders to fabrication of finished products a lot of work has been done. Standardization of

Pondicherry CM at NAL

SHRI V. Vaithilingam, Chief Minister of Pondicherry, paid a visit to National Aerospace Laboratory (NAL), Bangalore, on 24 July 1995. He was accompanied by Shri R. Narayana, Collector of Pondicherry, and other senior colleagues. The Chief Minister was escorted to NAL by Dr B.R. Somashekar and received by Dr K.N. Raju, Director, NAL.

While the primary objective of Shri Vaithilingam's visit was to witness the signing of an MoU on the Pondicherry solar pond power project, he also used the opportunity to meet NAL scientists, visit some of the NAL facilities and see an exhibition on NAL R&D capability specially set up for the occasion. The Chief Minister showed special interest in NAL's other energy projects, notably wind energy. In so far as the Pondicherry solar power pond project is concerned, a pilot 500 m² experimental salt gradient solar pond, with hot water temperatures up to 75-80°C, has already been established at the Pondicherry Engineering College. In the first phase, it is proposed to generate 6 kW in peak mode operation by employing an ORC engine to be designed and developed specifically by NAL for brine temperatures as low as 75°C. Once the experiment is successful it should be possible to eventually generate as much as 75 kW of power using the NAL system and the three larger solar ponds of 2000 m² area now under construction. □



Dr B.K.Sarkar, Director, CGCRI, delivering the welcome address at the Institute-Industry Meet organized by CGCRI, Calcutta

the processes has also been made. Several varieties of silicon nitride and hexagonal boron nitride powders, reaction bonded silicon nitride, dense silicon nitride, boron nitride and composites, etc. have been developed at the institute.

Time was therefore ripe to make the industries aware of the availability of these CGCRI processes so that they would utilize them commercially. Negotiations are in progress in this regard. It is against this background that this Institute-Industry Meet was held at CGCRI. Representatives from industries and Government organizations also took part in the meet.

The programme began on 25 April 1995 with welcome address by Dr B.K. Sarkar, Director, CGCRI. The inaugural address was given by Dr R.K. Mahapatra, CMD, MIDHANI, Hyderabad. The technical session was divided into two parts. The session I was devoted to addresses and lectures delivered by persons from industries such as Carborundum Universal, DMRL, Grindwell Norton Ltd, RDCIS, SAIL, DRDL, etc. The second session was exclusively devoted to

CGCRI's R&D activities and its experience with industries.

A panel discussion was also held to highlight the problems and prospects of non-oxide refractories/ceramics in industrial applications. Some key issues related to technology, world market, status and uses of these new materials were discussed. □

Training Course

Recent Developments in Roadway Support

WHILE inaugurating a five-day course on 'Recent Developments in Roadway Support in Mines' organized by Central Mining Research Institute (CMRI), Dhanbad, from 8 to 12 May 1995, the Director General of Mines Safety, Dhanbad, said that there should not be any compromise on mine's safety. He added, "The era of opencast mining is gradually being phased out. We are now stepping into underground mining, where we are likely to face the challenge of ground movement in a bigger way.

Foundation Stone of North-East Information Technology Centre laid

RECENTLY, Dr Manmohan Singh, Finance Minister of India, laid the Foundation Stone of North-East Information Technology Centre (NEITC) at Regional Research Laboratory, Jorhat. Addressing RRL scientists and distinguished guests present on the occasion, Dr Singh said, "In the new globalized setting in which the world had to operate, India cannot withdraw into a shell. We have to be confident that we have institutional mechanism which will enable our economy, our industry, our agriculture, our services, our educational institutions to operate at nothing but frontiers of knowledge". Giving his wishes to the centre, he went on to add, "Science and technology has truly emerged as the biggest single source of emancipation of human race. I salute all of you – our scientists, our technologists. You are doing the most creative work in the service of our nation and I am confident, in the years to come this laboratory will become a mighty centre of national research and true expansion of the cause of knowledge and truth." □

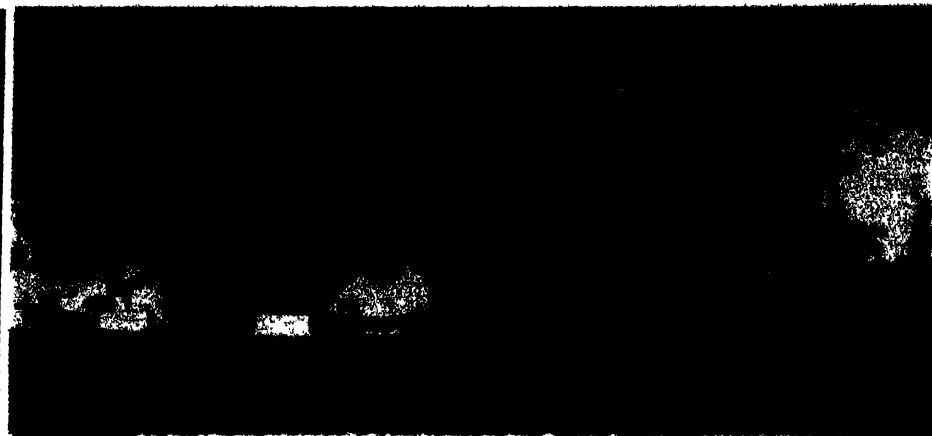
This calls for converting the present day art of mining into scientific mining to ensure better safety, production and productivity". But, he said, this proposition will remain only a desire unless there is an attitudinal change of those who are at the helm of mining industry. Earlier, Prof. Bharat B. Dhar, Director, CMRI, said, "Support of roadways is not only an essential requirement but is, perhaps, the key to an underground opera-

Foreign Delegation

South African team visits NAL

A team from CSIR, South Africa, led by Mr Don Jennings visited National Aerospace Laboratories, Bangalore, on 8 August 1995. After a brief meeting with Acting Director Dr B.R. Pal, Dr A.K. Singh and other senior NAL scientists, the team, accompanied by Dr Singh, visited some of NAL's R&D facilities, namely, Fiosolver Unit, FRP Pilot Plant, Failure Analysis Group, High Pressure Lab, Surface Technologies Group, Structural Integrity Division, Propulsion Division, and the 0.6m transonic wind tunnel. Some of the projects in which Mr Jennings and his colleagues showed great interest are: black chromium coating for solar energy applications; cutting tools based on cubic boron nitride; applications of composite materials; and generation of power using life-expired aero-engines. The team later visited C-MMACS where it met Dr K.S. Yajnik and his colleagues. A package of possible opportunities for collaboration in mathematical modelling and computer simulation was also discussed. □

tion. If the roads are not safe, if roads are not free, and if the maintenance of the roads is not economical it reflects on the production, on the movement of men and material, and thereby, can make a mining operation not only uneconomical but unsafe as well". In this context, he suggested, "Use of wooden support should be reduced and application of rockbolts should be increased. New support techniques like split set



Prof. Bharat B. Dhar, Director, CMRI, addressing the participants at the training course on 'Recent Developments in Roadway Support in Mines'

rock bolts, fibre glass rock bolts, etc, should be given trial. CMRI Geomechanics Classification should also be put into use for designing of roadway support". He also stressed the need to develop appropriate monitoring system to assess the effectiveness of these supports.

Dr A. Sinha, Scientist, CMRI, and Coordinator of the course, spelt out the course content, which included influence of geological parameters in supporting, rock bolting for roadway support, cable bolting for thick seam mines, and geo-technical classification based on CMRI technology. He further added that the course would also touch upon the guidelines for rock mass rating (RMR) and the techno-economics of the roof supports. Shri R.P. Singh, Scientist, HRD Cell, CMRI, proposed a vote of thanks.

The valedictory function of the course organized on 12 May 1995 was presided over by the Director General of Mines Safety. Dr T.N. Singh, Scientist G, CMRI, urged the participants to make use of the knowledge they had gained through the course in their actual field of work. Shri S.N. Mishra, General Manager (Personnel), BCCL, Shri

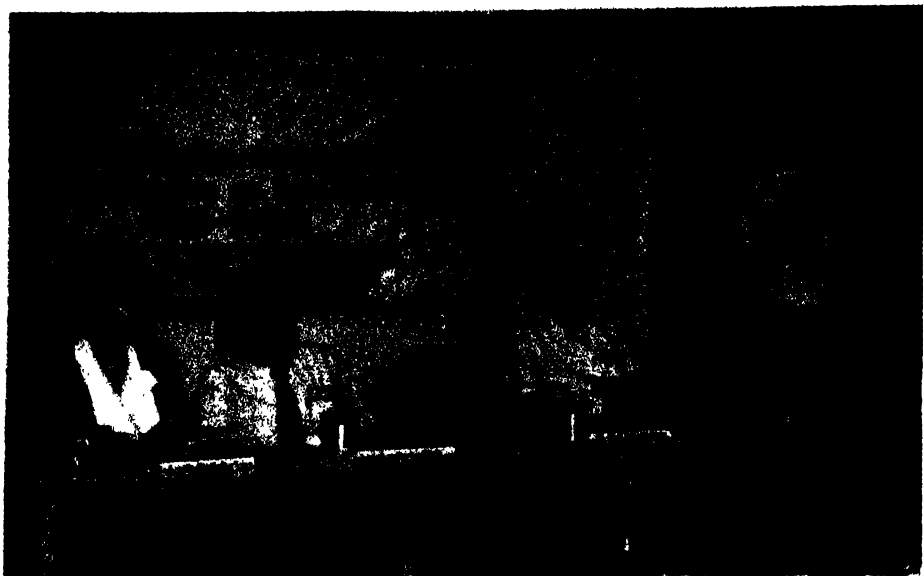
T.K. Mazumder, Director (R&D), DGMS, and Dr A. Sinha, Scientist, CMRI, also spoke on the occasion. Certificates were given away to the course participants by the Director General of Mines Safety. □

Workshop

Data Processing for CD-ROM Publishing

A workshop on 'Data processing for CD-ROM publishing' was organized at the Publications & Information Directorate (PID), New Delhi, from 28 August 1995 to 4 September 1995, for the representatives of participating organizations in the international consortium, Asian Health, Environment & Allied Databases (AHEAD). The workshop was attended by 13 participants from seven leading Asian organizations and was supervised by Ms Leah Polishchuk of the Canadian Centre for Occupational Health & Safety (CCOHS), Canada.

The workshop was inaugurated by Dr R.A. Mashelkar, Director General, Council of Scientific & Industrial Research (CSIR), New Delhi. Wel-



Dr R.A.Mashelkar, Director General, CSIR, delivering the inaugural address at the Regional Workshop on 'Data Processing for CD-ROM' at PID. Sitting on the dais (from left) are: Ms Leah Polishchuk of CCOHS, Canada, Dr Aung Gyi of IDRC and Dr G.P.Phondke, Director, PID and Executive Director, AHEAD



Dr R.A.Mashelkar, DG, CSIR, is being shown the computer facilities of CD-ROM Project at PID

gional representative of the International Development Research Centre (IDRC) at New Delhi also welcomed the participants to the workshop and underlined IDRC's interest in promoting dissemination of environment and health-related information in the Asian region.

The workshop was conducted to provide training in database building and allied aspects essential to CD-ROM publishing. Apart from a few lectures on basic concepts, the major focus of the workshop was on hands-on exercises using the data brought by different participants from their respective organizations. The topics covered included "Word Perfect", "SGML Coding", "PC-Write" "CC-PUB", "CC-BUILD" and "CC-FIND".

The workshop ended with the valedictory function on 4 September 1995. Dr P.P. Gupta, Member, Governing Body of the CSIR, was the Chief Guest at the valedictory function. Speaking on behalf of the participants, Miss A.H.Rillo of APINMAP, Philippines, thanked the host, PID, for making good arrangements for the workshop and suggested that another workshop should be held to consolidate the gains made by the participants in the workshop. Ms. Leah Polishchuk, the chief resource person, gave her impressions of the progress made by the participants.

In his valedictory address Dr P.P. Gupta exhorted the participants to actively promote the marketing of the CD-ROM products as their efforts to put together the information would become successful only if the disks reach the target groups. He also distributed certificates to the participants. □

coming Dr Mashelkar, other guests and the participants in the workshop, Dr G.P. Phondke, Director of PID and Executive Director of AHEAD, outlined briefly the genesis of the project and its main objectives. He hoped that the workshop would catalyze further cooperation among the organizations participating in the CD-ROM project.

Dr Mashelkar welcomed the initiative taken by PID in forging close links with other Asian organizations and acquiring expertise in the futuristic CD-ROM technology. He expressed satisfaction that PID was chosen as the lead organization of the international consortium after open bidding by different participating organizations. Dr Aung Gyi, Re-

New Publication

Space Time Waltz

SPACE Time Waltz gives a brief history of how classical physics based on our commonsense notions of space, time and matter was transformed into new physics of the twentieth century. The transformation began with the advent of Planck's quantum theory of radiation in 1900 and Einstein's relativity theory of space and time in 1905. The major concept involved in the former was that an object that absorbs (or

SPACE TIME WALTZ



emits) radiant energy can do so only in tiny irreducible bits called 'quanta' and not continuously. It was quite contrary to earlier ideas of classical physics about the nature of energy which was deemed to flow continuously and not in discrete tiny packets as Planck postulated. Likewise, Einstein's relativity theory denied the validity of classical physics's tacit assumption that all moving observers share the same space-time framework to locate and date the events they observe. It led to the demolition of the prevailing grand idea that our

universe of sun, planets, stars and galaxies was self-abiding and eternal. It always was because it could not have had any beginning. The startling upshot of Einstein's general relativity was that there was no time nor space nor matter some fifteen billion years ago before the birth of our universe with a big bang.

Nevertheless, the ideas Planck and Einstein introduced at the outset of twentieth century are the auspicious beginning to a wonderful flowering of physics. The entire twentieth century is the Golden Age of modern physics, during which it has grown from the adhoc origins into a fairly grounded mathematical discipline. Men of the intellectual calibre of Planck, Einstein, Bohr, Heisenberg, Pauli, Dirac, Gell-Mann, Hawking and several others were needed to bring these two momentous theories - General Relativity and Quantum Mechanics - to maturity.

Author: *Dr Jagjit Singh*; pp 156, Price: Rs 150

Order for this book should be accompanied by Money order/I.P.O./Demand draft/Cheque, made payable to 'Publications & Information Directorate, New Delhi,' and sent to: The Sales & Distribution officer, PID, Dr K. S. Krishnan Marg, New Delhi 110012. □

Patents Filed

Patent Application No. 175/DEL/95. **An intrinsically safe telephone exchange useful for areas having explosive atmosphere.** Inventors: S.C. Srivastava, S.Kumar, S. Srivastava, E. Tudu and S.R. Mitra. Central Mining Research Institute, Dhanbad.

Patent Application No. 176/DEL/95. **An improved pellistor useful for**

making a methane sensor and methane sensor incorporating the said pellistor. Inventors: S.C. Srivastava, S. Sinha, A.K. Singh, S.K. Sinha and P. Thakur, Central Mining Research Institute, Dhanbad.

Patent Application No. 283/DEL/95. **A process for production of fused tungsten carbide.** Inventors: B.C. Mohanty, S.K. Singh, P.K. Mishra, P.K. Sahoo and S. Adak. Regional Research Laboratory, Bhubaneswar.

Patent Application No. 284/DEL/95. **A process for improving the corrosion resistance of rapidly quenched metastable Pb-Sb alloy - ribbons.** Inventor: Dr. D. Mukherjee. Central Electrochemical Research Institute, Karaikudi.

Patent Application No. 285/DEL/95. **An improved process for the preparation of aryl substituted acids and their alkaline salts.** Inventors: R.V. Chaudhari, S.P. Gupte and A.A. Kelkar. National Chemical Laboratory, Pune.

Patent Application No. 287/DEL/95. **A process for deposition of conducting polymer films with enhanced stability on insulating substrates.** Inventors: S. Radhakrishnan and S.P. Khedkar. National Chemical Laboratory, Pune.

Patent Application No. 288/DEL/95. **An improved process for the purification of podophyllotoxin from crude podophyllotoxin/commercial podophyllin.** Inventors: S.M. Anand, S.M. Jain and R.S. Kapil. Regional Research Laboratory, Jammu.

Patent Application No. 289/DEL/95. **A process for the production of benzophenones.** Inventors: D. Bhat-tacharya, S.B. Kumar, A.P. Singh and P. Ratnasamy. National Chemical Laboratory, Pune. □

Raj Mahindra CAD Facility Inaugurated

THE new CAD Facility created at the Centre for Civil Aircraft Design Development (C-CADD) of National Aerospace Laboratories (NAL), Bangalore, has been named after the late Raj Mahindra. Raj Mahindra was after all, as Dr K.N. Raju, Director, NAL, aptly put it, "the father of NAL's Saras-Duet programme".

It was a touching inaugural function at NAL on the afternoon of 28 August 1995. Smt. Peggy Mahindra and Shri Shashi Mahindra were present for the inauguration. Prof. Satish Dhawan and Prof. U.R. Rao presided over the meeting while Prof. R. Narasimha formally inaugurated the Facility.

In his inaugural lecture, Prof. Narasimha paid an affectionate tribute to Raj Mahindra: "An unflinching commitment to aerodynamic design was the driving force of Raj's life. I hope his total professionalism (Raj was a stickler for getting every detail right), his professional stubbornness (Raj never gave up!) and dedication to the ultimate goal (for Raj the aircraft came first; and nothing else mattered) will characterize and inspire NAL's new centre".

Prof. Rao also warmly recalled his association with Raj Mahindra, "When I was trying to build India's first satellite with freshers, and had several questions on aerodynamic design, Prof. Dhawan simply told me: 'Get Raj'".

Dr M. Shivakumara Swamy proposed a vote of thanks in which he specially thanked Dr N. Ramani and his committee colleagues for their advice in the selection of the best computer configuration for the Raj Mahindra CAD Facility.

Announcement

Workshop on Modern Methods of Chemical Analysis for Minerals, Metals, Refractory Materials and Ferro-alloys

QUALITY product at an international competitive pricing is the sole winning strategy of the day. ISO 9000 is the buzz-word in every organization that aspires to go global. Metals and allied industries which are already facing competition from alternative materials are no exception. It therefore becomes necessary for these industries to monitor their raw materials and end products through strict control regimes. Rapid and effective analytical control at different stages of production of high quality materials is, perhaps, the main driving force for a continuous search for newer methods of analysis. The possibilities to solve analytical problems have increased markedly during the last decade with the availability of a number of new instrumental techniques. Much of our capability to control chemistry and achieve batch-to-batch uniformity in today's production is due to advances achieved in analytical information.

Keeping in view the suggestions made by the participants of our earlier workshops in 1991 and 1994, National Metallurgical Laboratory (NML), Jamshedpur, is organizing a similar workshop W-MMCA '96 with a wider scope in February, 1996. The basic aim would be to update the knowledge/expertise in the chemical analysis of materials as referred earlier through lectures by experts and practical demonstrations together with hands-on practice. The workshop will give an opportunity to senior level analysts, material scientists, engineers and technologists from various R & D laboratories, industries (mining, metallurgical and refractories) and educational institutions to keep themselves abreast of the latest developments in modern methods of analysis.

The workshop will cover following fields: Atomic Absorption Spectrophotometry - flame & flameless; Direct Reading Emission Spectrometry; Inductively Coupled Plasma Spectrometry; X-ray Fluorescence Spectrometry; UV-Visible Spectrophotometry; Carbon, Sulphur Determination; Complexometric Method of Analysis, and Proximate Analysis of Coal.

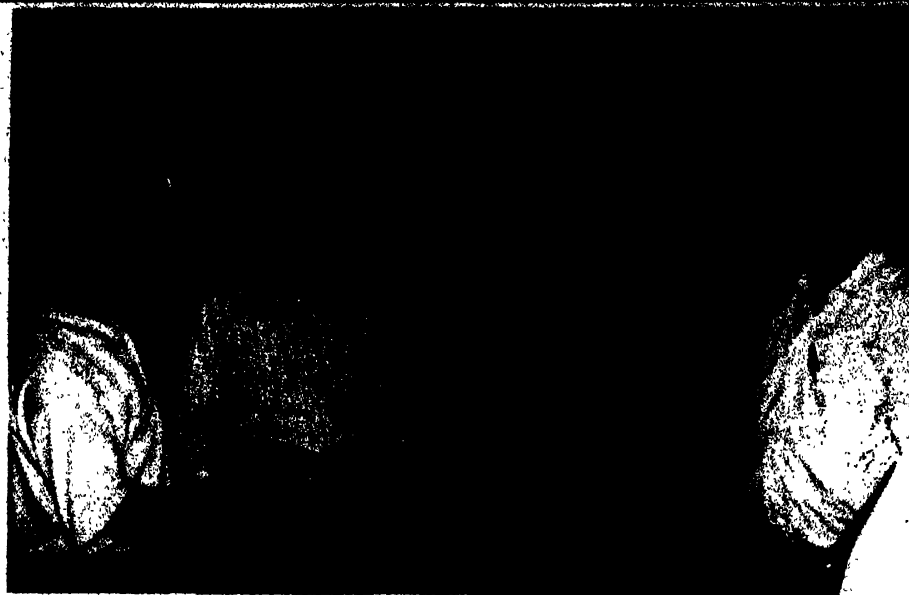
Registration Fee is Rs 4500/- per Indian delegate or US \$ 250 per foreign delegate. It is Rs. 3000/- per delegate if accommodation is not required.

Fee is payable by crossed cheque/demand draft in favour of "W-MMCA 96" payable at SBI Jamshedpur. The duly filled registration form should be sent to the Course Coordinator before 17th October, 1995. For cheques, include Rs 20/- as service charges.

For further information, please contact: Dr. S.C. Srivastava, Course Coordinator, Analytical Chemistry Division, National Metallurgical Laboratory, Jamshedpur - 831 007; Ph: 426091-426096 Extn. 634(O). □

PID participates in Delhi Book Fair

THE Publications & Information Directorate (PID), New Delhi, participated in the 'Delhi Book Fair' held in New Delhi from 12 to 20 August 1995. It was organized jointly by the Federation of Indian Publishers and Indian Trade Promotion Organization. The display put up by PID attracted a large crowd of students, teachers and academicians besides dignitaries from central and state governments. It yielded a business of more than one lakh rupees to PID. The 'Popular science books' brought out by PID were the main centre of attraction at the exhibition. The publications on medicinal



Shri Salman Khursheed, Minister of State for External Affairs, Government of India, having a close look at PID's publications

and aromatic plants also received much acclaim. The three popular science magazines — *Science Re-*

porter, *Vigyan Pragati* and *Science ki Duniya* — were highly appreciated by the visitors. □

The Raj Mahindra CAD Facility includes a well-balanced computer system with PCs, workstations and an adequate number of high quality devices to aid design, drafting, and development work.

The major drafting facility consists of 12 Intel 486 based PC ATs connected together using a thin ethernet network to share the resources. The facility will essentially use the AutoDesk Auto CAD Rel 12 package, with an advanced modelling extension to carry out basic 3D operation, the Auto CAD designer and the Auto CAD data extension module to manage drawing files efficiently.

For the high end CAD solution of designing aircraft components, the centre has a carefully formulated match of RS-6000 workstations from IBM and CATIA by Dassault. The latter is now the de facto standard in the aircraft industry for CAD solutions. The overall hardware consists of a

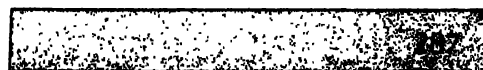
main server with 128 MB RAM, 9 GB external disk, a 24 bit graphic card, a stand-by server with 8 bit graphic card and five IBM RS-6000 workstations each with 64 MB RAM. These have been networked through a 16 port unmanaged hub.

The CATIA modules include a wide range of functionalities from basic wire frame modelling to NC tool path generation, interface to other packages for analysis and a host of other capabilities. Apart from these, a 486 based SCO Unix server with several VT100 and X-terminals will cater to the needs of design, aerodynamics and structural calculations. The output devices consist of two AO size direct imaging plotters from Calcomp, a high quality pen plotter from Graphtech, a A3/A4 size laser plotter, A3/A4 size Calcomp colour printer and a large number of dot matrix printers. All these printing devices will be shared on a local area network. □

Prof. Dhar participates in World Bank Round Table

PROF. B.B. Dhar, Director, Central Mining Research Institute (CMRI), Dhanbad, participated in the Round Table on Artisanal Mining, organized by the World Bank in Washington D.C., USA, from 17 to 19 May 1995. He was specially invited to this Round Table because he has already carved out a niche in the field of mining and mining environment not only in India but also neighbouring countries, particularly South East Asia. The aim of the Round Table was to highlight the problems and issues of artisanal mining in the world and evolve strategies for better environment control, impact on society as a whole, among other things.

Prof. Dhar took active part during the deliberations and presented the problems in mining and mining



The Institute more responsive to industrial/societal needs and to become self-reliant CSIR has merged its two divisions at Headquarters, namely, Planning Division and Technology Utilization Unit, into a single one. This new Division will henceforth be called 'R & D Planning and Business Development Division'. Dr. H.R. Bhojwani has taken over as its Head.

The International Scientific Collaboration Division has also been renamed as 'International S & T Affairs Directorate'. Dr R.K. Bhandari will head this directorate.

The Patent Unit has been renamed as 'Intellectual Property Management Division'; Shri N.R. Subbaram has taken over as its head. The Rural Development Cell has been renamed as Rural Development Unit; Shri A.K. Bhatia will head this unit. □

environment with special reference to artisans and small scale mining related to the area he represents, in a convincing manner. He was also invited last year by the World Bank to take part in the International Conference on 'Development, Mining and Environment' held in June 1994 at Washington, D.C. □

Honours and Awards

A.N. Bhaduri

PROF A.N. Bhaduri, Director, Indian Institute of Chemical Biology, Cal-

cutta, has received the Indian National Science Academy's Jagadish Chandra Bose Medal for the year

1995 for his contributions to enzymology and biochemical parasitology.

UN Award for CGCRI Invention

A new process on wood substitute developed at the Central Glass and Ceramic Research Institute (CGCRI), Calcutta, has been selected for World Intellectual Property Organization (WIPO) Award '95. This was announced by National Research Development Corporation (NRDC) at New Delhi on September 8, 1995 on behalf of WIPO.

WIPO is a specialized agency set up by the United Nations to promote protection of intellectual property throughout the world and it has instituted such annual awards for last two decades in the form of India-Gold and India-Silver medals to be given to the best inventions made in India during last one year.

It is for the first time that a process developed at CGCRI, Calcutta, has received such an honour; it has bagged the UN Award of India-Gold Medal.

The invention of "Glass reinforced gypsum composite, a partial substitute of timber" developed by K.K. Phani, S.K. Som, M. Roy Choudhury, S. Ram and P.L. Chanda can be used as a partial substitute of wood for the manufacture of doors and wall panelling, partitions, false ceilings, table tops and cupboards. It can therefore serve as a domestic utility item, save trees and help restore ecological balance. □

Lalji Singh

DR Lalji Singh, Senior Scientist, Centre for Cellular & Molecular Biology, Hyderabad, has been selected to give the Indian National Science Academy's Professor Vishwa Nath Memorial Lecture for the year 1995. He has been selected for this honour due to his significant work on the molecular organization and evolution of sex chromosomes. □

ICICI - CSIR MoU signed

As a step towards corporatising its laboratories, the Council of Scientific and Industrial Research (CSIR) has signed a Memorandum of Understanding (MoU) on 30 August 1995 with the Industrial Credit and Investment Corporation of India Ltd (ICICI). The MoU would enable CSIR to set up commercial arms for its laboratories to market its services, products and expertise as well as in its efforts to generate resources through financial investments. Under the agreement signed by Dr R.A. Mashelkar, Director General, CSIR, and N. Vaghul, Chairman, ICICI, the latter would help enhance the skill base of CSIR staff for project appraisal, to forge stronger links between industry and CSIR research programmes. CSIR scientists and experts would be nominated on the board of directors of ICICI-assisted companies to bring technology to corporate board rooms and help CSIR experts understand issues of concern to industry. □

CSIR



VOL 45 NO 19 15 OCTOBER 1995

CSIR FOUNDATION DAY CELEBRATED

IN THIS ISSUE

CSIR Foundation Day celebrated	289
1995 CSIR Young Scientist Awardees	290
1995 CSIR Technology Award winners	291
CSIR Foundation Day Lecture : CSIR Vision 2010	291
Dr R.K. Bhandari is Head, ISTAD	295
National Botanical Research Institute, Lucknow R&D Highlights : 1993-94	299

// IT is high science with a purpose that should be the endeavour and domain of CSIR. Thus science that would be the harbinger of technology of the future is what CSIR should be concentrating on", said Shri Bhuvnesh Chaturvedi, the Minister of State for S&T and Vice President, CSIR, at the glittering function held on 26 September 1995 at National Physical Laboratory, New Delhi, to mark the CSIR Foundation Day. "I am indeed very happy that

despite its commitment to competitive global R&D, CSIR has constantly kept in view the needs of the Indian masses and developed a large number of technologies that directly affect their lives providing them with new and improved means to earn their living and enabling them to live in cleaner, healthier surroundings", Shri Chaturvedi continued, "CSIR's contributions in building materials and construction and leather sector have specially helped the common



Shri Bhuvnesh Chaturvedi, Minister of State for S&T, releasing a book on rural technologies developed by CSIR on the occasion of CSIR Foundation Day held on 26 September 1995 at NPL auditorium. Also seen in the picture are (from left) Dr B.S. Mathur, Acting Director, NPL, and Prof. S.K. Joshi, Ex-DG, CSIR

1995 CSIR Young Scientist Awards

Physical Sciences: (i) Dr Rina Sharma of the National Physical Laboratory, New Delhi, for her innovative modification of Moiré's technique for water-mask alignment of very high accuracy. (ii) Dr Premod Kumar Khanna of the Central Electronics Engineering Research Institute, Pilani, for his innovation in the development of thick film hybrid circuits.

Chemical Sciences: Dr Manobjyoti Bordoloi of the Regional Research Laboratory, Jorhat, for his significant contribution to the development of selective and novel electron transfer process of potential importance in synthetic organic chemistry.

Engineering Sciences: (i) Dr Sidhartha Bandyopadhyay of the Central Glass & Ceramic Research Institute, Calcutta, for his work on the development of monolithic silicon refractories and other ceramic materials from indigenous raw materials. (ii) Dr S. Srikanth of the National Metallurgical Laboratory, Jamshedpur, for innovative use of thermodynamic models towards

the development of catalytic efficient process.

Earth, Atmosphere, Ocean and Planetary Sciences: (i) Dr Ravadhansu Manikanta of the National Geophysical Research Institute, Hyderabad, for her significant work in the geochemistry of the Precambrian rocks of Karnataka, especially banded Iron formations (BIF) of Sandur Schist Belt. (ii) Dr Kirti Srivastava of the National Geophysical Research Institute, Hyderabad, for her significant contributions in the field of seismic signal processing and modelling of the stochastic hydrogeological processes.

Special Prize : 1995

A Special Prize of Rs. 10,000 has been awarded to Master Rohit Tandon, a student of the City Montessori School, Lucknow, for his significant achievement of winning top honours at the Robotics Olympiad held at New Mexico, USA, in May 1995 for his robot 'Stulob' (String the Universe in One Bond).

workers and the weaker and disadvantaged sections of our society". Referring to the CSIR Young Scientist Awards which he presented to the recipients on the occasion (See box for details), Shri Chaturvedi said, "The Young Scientist Awards reflect the sound and substantial foundations in scientific research that CSIR is promoting amongst its people. In fact, CSIR laboratories are a nursery and training ground for our young budding scientists. This linkage between CSIR and the academic community has provided CSIR with the much needed 'vitality' and infusion of creative ideas". The Minister also released two books, a Compendium of Rural Technologies developed by CSIR and a Directory of NRI Scientists and Technologists, on the occasion. The directory, said the Minister, "should enable our S&T community and industry to draw upon and tap the vast and versatile talent bank of the NRI community for national advantage".

Earlier, Prof. S.K. Joshi, Ex-DG, CSIR, now associated with National Physical Laboratory (NPL), New Delhi, delivered the CSIR Foundation Day lecture entitled 'CSIR-Vision 2010'. Prof. Joshi, who has worked for nine years in CSIR, first as Director, NPL, and then as D.G., CSIR, urged CSIR scientists to explore new ways of financing major developmental programmes jointly by industry and financial institutions to realise the CSIR Vision 2010 (For more details, see page 291 for extracts of the lecture). In his welcome address, Dr R.A. Mashelkar, DG, CSIR, said that a White paper on gearing up CSIR in tune with the changing global scenario is being prepared and would be finalised after a meeting of the Directors of CSIR laboratories to be held soon. He also announced the



Dr R.A. Mashelkar, D.G., CSIR, giving the welcome address at the CSIR Foundation Day function

...the CSIR Foundation Day Lecture delivered by Prof. S.K. Joshi at National Physical Laboratory (NPL) Auditorium on 26 September 1995. Prof. Joshi is Ex-DG, CSIR, and is presently conducting research at National Physical Laboratory, New Delhi

The CSIR Awards for Technology and Engineering are presented annually to recognize and encourage outstanding achievements in the field of science and technology. The Awards are presented in the form of a Shield, a plaque, a citation and a cash award of Rs 20 to 30 lakh, and five Technology Prizes, one each in the area of Biological, Chemical, Engineering and Materials Technology and Business Development and Technology Marketing; each carrying a plaque, a citation and a cash award of rupees one lakh.

This year the Shield in the area of Process Technology and Prizes in the area of Biological Sciences & Technology and Materials Technology have not been awarded. The awardees for 1995 are:

Shield for Engineering Technology is awarded to National Aerospace Laboratories, Bangalore, for its outstanding achievements in diverse engineering fields covering composite materials, parallel computing, control system and specialised surface coatings. The contributions have enabled the country to move towards technological self-reliance in the aerospace sector.

Prize for Chemical Technology is awarded to the team at Indian Institute of Chemical Technology, Hyderabad, comprising Sarveshree

...the CSIR Awards for Technology and Engineering are presented annually to recognize and encourage outstanding achievements in the field of science and technology. The Awards are presented in the form of a Shield, a plaque, a citation and a cash award of Rs 20 to 30 lakh, and five Technology Prizes, one each in the area of Biological, Chemical, Engineering and Materials Technology and Business Development and Technology Marketing; each carrying a plaque, a citation and a cash award of rupees one lakh.

The CSIR Awards for Technology and Engineering are presented annually to recognize and encourage outstanding achievements in the field of science and technology. The Awards are presented in the form of a Shield, a plaque, a citation and a cash award of Rs 20 to 30 lakh, and five Technology Prizes, one each in the area of Biological, Chemical, Engineering and Materials Technology and Business Development and Technology Marketing; each carrying a plaque, a citation and a cash award of rupees one lakh.

Prize for Engineering Technology is awarded to the team at Central Mining Research Institute, Dhanbad, comprising Shri Sibnath Maity and Professor B.B. Dhar for the development of a simple but novel 'High Set Remote Prop'. It enables the load and height setting to be changed and provides for remote setting and withdrawal of the prop ensuring safety in underground coal mine working especially of freshly exposed mine faces. The technology has been commercialised by several small scale units.

Prize for Business Development & Technology Marketing is awarded to National Chemical Laboratory (NCL), Pune, for evolving innovative mechanisms and pioneering globalisation strategies that have enabled it to significantly enhance business and market for its knowledgebase nationally and internationally. As a result of the meticulous and painstaking efforts, NCL is now recognised the world over for the quality and timely delivery of R&D outputs. □

Extracts of the CSIR Foundation Day Lecture delivered by Prof. S.K. Joshi at National Physical Laboratory (NPL) Auditorium on 26 September 1995. Prof. Joshi is Ex-DG, CSIR, and is presently conducting research at National Physical Laboratory, New Delhi

CSIR Vision 2010

NEVER before in the past has CSIR experienced such a wind of change and such a change of environment as in past four years following the new liberalised economic and industrial policies of the Indian Government. Globalization is in the air. Multinationals are entering the country with their own technologies, capital and brands. These changes mean immediate and long term threats and challenges for the CSIR system. These new environments require the CSIR to generate technologies and provide services which are world class. CSIR is adjusting itself reasonably to these new environments and is managing the change smoothly. The CSIR community has accepted these changes, and by and large regards them to be for its own good.

Vision 2010

India today is a consumer of technology. Our vision is that by the year 2010, CSIR should make our country a global contributor of innovative technology. CSIR has to become an efficient high technology enterprise and a home of innovative technologies which will be respected all over the world.

This vision 2010 has to be shared by all members of the CSIR and they all have to be committed to realize this vision. This would demand com-

S.S. Bhatnagar Prize winners for the year 1995 (See CSIR News, 30 September 1995) and the CSIR Technology Awards for the same year (See box for details). He made a special

mention of the scientific achievements of Master Rohit Tandon, a student of City Montessori School, Lucknow, who has bagged the CSIR Special Prize. □

mitment, determination, enthusiasm and perseverance from the whole CSIR system. Some of the major initiatives which we have to take to realize this vision are listed below:

Partnership with Industry

To enhance India's competitiveness in the global markets through excellence in technology, a strong partnership with industry is essential. CSIR has to take positive actions to stimulate partnership with industry in technology development. Our laboratories have to realize that most of the innovation occur through incremental improvements in existing products and processes, and industry is better placed for actualising this. Laboratories should help the industry to change or improve products through a combination of evolutionary and revolutionary product improvements. In this regard the success of Indian Institute of Chemical Technology, Hyderabad, in providing innovative process for known drugs is worth mentioning.

The new pressures generated by competition are likely to drive Indian industry closer to industrial research. CSIR has to convince the industry that innovation through R&D will enhance productivity and will help them expand the market share of their products. The growing synergistic relationship between CSIR and industry is confirmed by increasing external funds coming from industry to CSIR laboratories. This healthy trend should grow in future and CSIR should be able to help the industry to be globally competitive, and add value to products and services.

CSIR scientists would have to learn more about industry in order to interact effectively with it. This would require extended visits to industry. It is important for the CSIR scientists to



Prof. S.K. Joshi delivering the CSIR Foundation Day Lecture at NPL auditorium

be able to recognize a potential product arising out of their R&D efforts, assess the time frame for the product development, identify the risks and marketability. Our scientists needed to be exposed to innovative product planning. Ultimate decision about a new product is taken by industry on the basis of market and commercial consideration.

In transforming an R&D effort into a product or a process, wherever necessary the upscaling work should be done in industry in order to adapt or modify the R&D to suit the manufacturing requirements. In order to shorten the time needed for commercialization, the industry's team should start interacting with the R&D team of the laboratories from the very early stages.

CSIR should help our industry to leapfrog with the help of R&D to produce products of twenty first century before others could do so. There would be problems in carrying the industries along, but the rewards of success would be very high. CSIR may have to perfect the secrecy agreement to be signed with an in-

dustry. The scientists have to develop a code of conduct so that the industry can come with more confidence to laboratories. A satisfied industry telling another how happy it is with CSIR technology or service is worth its weight in gold.

The small scale sector contributes over 40% of India's total exports, amounting to over Rs. 170,000 million in 1993-94. The small scale sector relies heavily on outside R&D. A close link with CSIR laboratories would prove fruitful. CSIR should see how the existing ties with small scale sector can be further strengthened. In 1994, CSIR joined hands with National Small Scale Industries Corporation and the UN Asia and Pacific Centre for Transfer of Technology to create an awareness and assist the small scale industry on technology acquisition and modernization.

Setting Priorities

In the new circumstances of working closely with industry, CSIR has to focus and concentrate on a few major programmes. This is unavoidable if CSIR wishes to remain competitive in

industrial research. In selecting projects and priority setting we would have to use inputs from industry, results of market surveys, studies commissioned from consultants and global monitoring to track developments in industrial research. This is a highly participative exercise involving scientists of laboratories, policy makers from Planning Commission and concerned ministries, industries, experts and consultants.

Broad consultation with laboratory scientists would ensure their commitment and may provide inputs which are useful for implementation of a programme. Whatever we may do, we cannot wish away the ground realities prevailing in our laboratories. These will change and the change can be accelerated, but there is always a relaxation time which is partly determined by the local environment.

CSIR has to look for niche areas in which India has the potential to master technologies for a clear competitive edge. Biotechnology appears to me to be one of the genetic technologies where we have the core strengths in our laboratories. The industries, marketing people (who have world wide reach) and the CSIR laboratories together should identify opportunities for research and product development. Along with the Department of Biotechnology and some consulting firms, CSIR should promote biotechnology to the business sector with a view to commercialize the high quality R&D going on in many of our laboratories.

Present times are dominated by information science. The information revolution has already reshaped the business world and now it is spilling out of the office to touch every aspect of our lives. It would be desirable if a group could advise CSIR to

identify fields in information technology where CSIR could develop R&D programmes with a broad and long range view of the markets. At present information science projects do not figure prominently in CSIR. In addition to developing some major programmes in information science, CSIR should become country's primary authoritative provider of information to industry regarding different technologies.

Agriculture sector is very important for the Indian economy. CSIR can provide here new technologies/services to food processing and food preservation industries. Special attention should be paid to technology needs of small scale sector in rural areas. Such efforts would lead to additional income for farmers and would amount to high value addition to local materials. NGO's participation in disseminating information on rural technologies and in taking these to villages is needed. May be CSIR should chalk out a programme in consultation with Ministry of Rural Development and some selected NGOs.

Ageing of CSIR

CSIR was founded fifty three years ago and most of its laboratories are very old. In recent years, inadequate and suboptimal investments have been made in renewing the physical and research infrastructure (the people, instruments, information systems and buildings). The Review Committee (Abid Hussain Committee) recognizing this grave situation had recommended in 1987, an immediate and separate grant of Rs 1000 million spread over three years to modernize the infrastructure in CSIR. Today, due to inroads of inflation and readjustment of the value of rupee, an amount of Rs 2500 million

would be needed to modernize the infrastructure in CSIR.

It is important that our laboratories have the cutting-edge instrumentation and a world class information and communication system. It is necessary that the CSIR establishes a communication network so that all laboratories can communicate with each other. Effective and quick communication is a prerequisite of smooth collaboration between different laboratories.

The most of the support and technical staff in CSIR laboratories were recruited decades back. In order that these people contribute optimally to new programmes, we have to impart new skills and new information to them. The training of these people should be comprehensive. There should be a rigorous examination and certification. Those who do well in the training should be given an enhancement of status and a promotion. These and other measures are needed in order that the CSIR realizes its full human resource potential.

In CSIR there has been an insignificant inflow of new talent in most of the laboratories in recent years. The average age of scientists in the CSIR is rather high. This has adversely affected the innovativeness and creativity of CSIR. There is, thus, an immediate need to induct R&D personnel at an appropriate level to nucleate and lead groups in new prioritized areas. There is also a need to redeploy and reorient existing personnel in new programmes after appropriate training and upgradation of skills.

Goals for Realization of the Vision

The vision that CSIR becomes a global player in technology generation by the year 2010 should be shared by all segments of CSIR scientists, engineers, technicians, support staff and administration. We have to excite their enthusiasm to transform CSIR. There should be a strong commitment to this vision from everyone in CSIR. Some of the operational goals to realize the vision 2010 could be as follows:

1. We should galvanize strong links between CSIR system and industry. The Director General has already initiated steps which will make it possible for laboratories to interact with business in a more flexible and resilient manner.
2. CSIR R&D should lead us soon to a position where industry is able to launch more and more innovative products based on CSIR knowhow.
3. In order to compete internationally, CSIR R&D has to become much more efficient. CSIR should think globally rather than locally as far as high technology is concerned.
4. New ways of financing major developmental programmes jointly by industry and financial institutions would have to be explored.
5. The feedback from industries as user of CSIR technologies/services should be utilized by the laboratories to improve upon the technologies/services.
6. In order to make transition from traditional to advanced technologies, we should leapfrog and work closely with industry. The environmental concerns should be kept in mind in all new technology development projects.
7. Government should be persuaded to foster conditions and introduce measures (fiscal and budgetary) which will stimulate the private sector investment in R&D and in facilities which are needed today for conducting competitive R&D.
8. CSIR should promote vigorously the commercialization of technologies developed by CSIR laboratories. Training of CSIR personnel in marketing of knowledge base is necessary. The marketing groups at the laboratories need to be strengthened.
9. The strategic plan of CSIR for vision 2010 would have to be converted into prioritized action plan at the level of laboratories. The laboratories should define their own prioritized action plan in line with the overall strategy of CSIR. A balance between centralized and decentralized decision-making would have to be maintained in such matters.
10. Focus, prioritization, accountability and evaluation should become the keywords in CSIR system.
11. CSIR has to look for niche areas in which it has the potential to be ahead of others in the world.
12. The networked projects which bring together different laboratories of CSIR to work on a few selected programmes should be provided preferential financial support.
13. Special attention should be paid to development of technologies/services for the small scale sector and the rural sector.
14. Management of intellectual property and its protection through international patents should be given high priority. The existing patent handling facilities in CSIR need to be strengthened quickly.

15. More bright and creative young people need to be induced in CSIR. CSIR would need more engineers than scientists.

16. There is need to make a career in CSIR an attractive one for a young person. This would mean setting in place incentives and career advancement opportunities for bright and innovative persons in recognition of their contributions. Young scientists of proven merit should be given higher responsibilities and competitive support.

17. The present system of career development in CSIR, MANAS, has adversely affected the work culture in the laboratories. A major overhaul of MANAS and the entire personnel policies is needed to enable CSIR to meet the challenges it faces.

18. Human resource development in CSIR should be given a high priority. Training and re-training of technical and support personnel for the new tasks should become an integral part of CSIR strategy. Scientists and engineers need to be exposed to marketing, innovative product planning and emerging technologies and technology transfers.

19. Modernization of CSIR infrastructure has to be accorded a high priority and a financial allocation of the order of Rs.2500 million would be needed for this purpose.

20. CSIR should maintain the strength in basic sciences which will provide it the flexibility and ability to face fast changing scenario in technology development. Interaction with universities will also prove helpful here.

On this Foundation Day, our true tribute to the founding fathers of CSIR would be to dedicate ourselves to actualizing this vision through sustained hard work. □

Dr R.K. Bhandari takes over as Head of International Science & Technology Affairs Directorate of CSIR

DR R.K.Bhandari, an eminent civil engineer and a well-known science administrator, took over as the Head of the International Science & Technology Affairs Directorate at the CSIR Head Quarters on 1 August 1995.

More than three decades ago, Dr Bhandari had started his career with CSIR as a young scientist in the Central Road Research Institute, New Delhi. Later he moved on to Central Building Research Institute in Roorkee, of which he was the Director from 1986 to 1990. In August 1990, he joined the United Nations Centre for Human Settlements (Habitat), Nairobi, as the Chief Technical Adviser and Senior Engineering Adviser of a major UNDP supported project on Natural Disaster Reduction in Sri Lanka, and continued serving the United Nations upto July 1995.

Dr Bhandari has had a distinguished academic track record throughout. After obtaining his Bachelor of Civil Engineering degree from the University of Rajasthan in 1962, and his M. Tech. degree in Civil Engineering from the Indian Institute of Technology, Bombay, he pursued his Ph.D. research at the Imperial College of Science & Technology, London, as a Science Research Scholar of the Royal Commission for the Exhibition of 1851. During 1967-72, he studied landslides of the Isle of Sheppey, Isle of Wight and of the Northern Ireland which earned him a DIC from the Imperial College of Science & Technology, and the degree of Ph. D. from the University of London. NERC, UK, funded his research.



Dr Bhandari has been very closely associated with Geotechnical Engineering professional activities at the national, regional and international levels. He is among the very few Indian geotechnical engineers to be especially invited on virtually every major international geotechnical event, especially International Conferences on Soil Mechanics and Foundation Engineering (ICSMFE) held in Tokyo (1977), Stockholm (1981), San Francisco (1985), Rio-de-Janeiro (1989), and New Delhi (1994), International Conferences on Case Histories in Geotechnical Engineering held in St. Louis, USA, in 1984 and 1988; and the Asian Regional Conferences held in Singapore (1979), Haifa (1983), Tokyo (1987) and Bangkok (1991).

Dr Bhandari's pioneering contribution, however, came in the field of landslide studies and their engineered remediation. He was the first to propose undrained loading as the fundamental mechanism of low angled mudslides, established jointly

with Prof. J.N. Hutchinson of Imperial College, London. It provides the oft-quoted scientific explanation to genesis of other forms of mass movements. For well over two decades, he studied a number of landslides particularly in the Sikkim, Himachal and UP Himalayas. The results of the studies were extensively published in the national and international journals and conference proceedings. He was frequently invited to present his professional work on landslides through keynote lectures and state-of-the-art reports. Of special mention are the presentations made at the International Symposia on Landslides held in Tokyo (1977), New Delhi (1980), Toronto (1984), and Laussane (1988).

Dr Bhandari led CSIR delegations to: 10th CIB Congress in Washington in September 1986; Bhutan in October 1987; ISO meeting in Berlin in 1988; Riga, USSR, in May 1990; Royal Scientific Society of Jordan in March 1990; and UNCHS-USSR-CSIR Mission on Building Materials to Tanzania and Kenya in January 1990. He also represented India at the meeting of the Directors of the English Speaking Building Research Organizations (DESBRO) and at the CIB Board meeting, Garston, UK, in June 1989. He is widely travelled and has delivered invited seminars in many countries including UK, USA, USSR, Japan, Hong Kong, Sri Lanka, France, Austria, Australia, Canada, Brazil and Thailand. He was an academic visitor to the University of Wollongong, Australia, in 1980.

Numerous awards have been bestowed on Dr Bhandari for his professional contributions. He received Bhasin Foundation Award in Engi-



Mission, Mandate and Major Activities of ISTAD

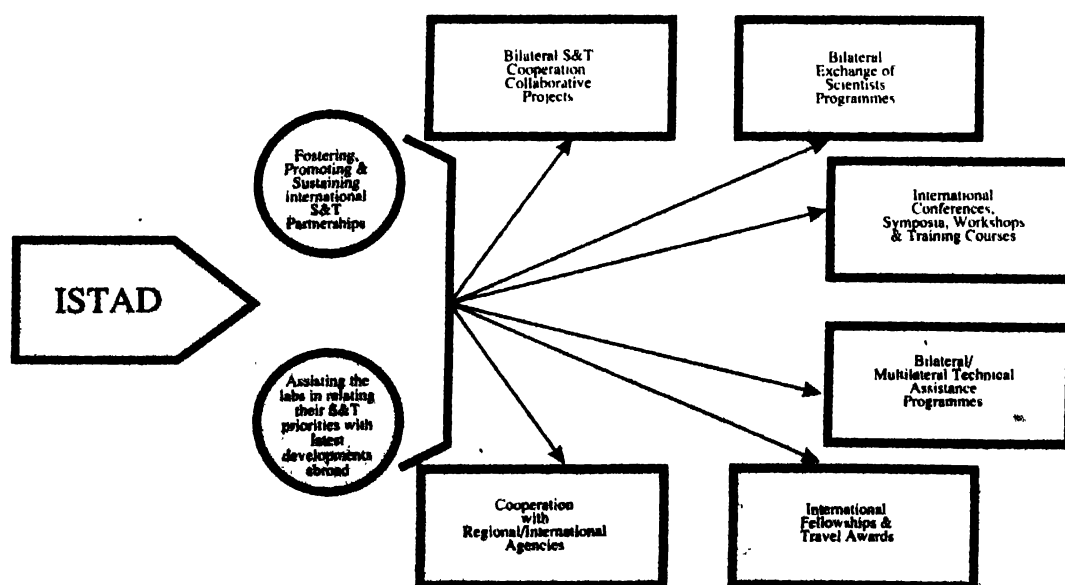
ISTAD's Mission

To Foster, Promote & Manage International Science & Technology Affairs of the CSIR leading to an environment in which Scientific Industrial Research will naturally grow, flourish and deliver.

ISTAD's Mandate

- To help make CSIR's scientific & technological knowledge-base internationally competitive by all possible means, especially by vibrant national and international networking and partnership.
- To assist the CSIR system in scouting for, and pinpointing, the very latest of internationally competitive scientific and technological advances, and breakthroughs of relevance to India, that should mould, shape and energize CSIR's current and future research and development initiatives.
- To build and fortify bridges of understanding between the CSIR and all its major overseas Science and Technology partners to develop synergies and leverage CSIR's capabilities in core areas of S&T interest.
- To reinforce CSIR's existing S&T base through international scientific and technological collaborations, twinning of institutions and such other initiatives.
- To vitalise CSIR's inputs through engineered training and retraining of scientists in core sectors (to be pinpointed from time to time), and at the same time help exploit the enormous trainer potential of the CSIR laboratories to forge and reinforce international partnership.
- To provide an extra wheel to the vehicle for CSIR's journey towards a global R&D platform.
- To serve as an international clearing house of information on Indian Science and Technology, especially in the major areas of tactical national, regional and international interests to the CSIR. □

ISTAD's Major Activities



neering & Transport for 1988; Plaque of Honour from the South-East Asian Geotechnical Society in December 1987; Plaque of Honour from the Japanese Society of Soil Mechanics in July 1987; AIMIL Gold Medal and Natural Minerals & Chemical Companies Prize for the best professional paper; Asia Foundation and Construction Private Limited Award for the best professional paper; Institution of Engineers (India) certificates of merit; and Jai Krishna Prize of the Institution of Engineers (India).

He was elected as the Fellow of the Institution of Civil Engineers, London, in May 1990; Fellow of the Indian National Academy of Engineering in 1988; Fellow (Life) of the Institution of Engineers India; and Fellow (Life) of the Indian Geotechnical Society.

He is a member of the International Commission on Landslides (1985-1997); Member of the International Committee on Landslides (1981-1997); Vice-President, International Council of Building Research Studies & Documentation (CIB) (1989-1991); President of the Indian Geotechnical Society (1987-1989); Chairman of the Soil Engineering Sectional Committee of Bureau of Indian Standards (1986-1989); and Chairman of the Foundation Engineering Sectional Committee of the Bureau of Indian Standards from 1990 to date.

Dr Bhandari has published more than 150 scientific and technical papers; co-ordinated more than 100 major projects which include the UN sponsored project on Natural Disaster Reduction in Sri Lanka; CSIR thrust area projects on Taj Mahal and on Low-cost Building Materials; DST project on Eco-development in the Himalayas and on spliced piles. He has filed six patents jointly with his

colleagues, and has examined/supervised 14 Ph.D. theses.

The major areas of professional interest of Dr Bhandari include geotechnical engineering; sustainable development of housing and in-

frastructure in disaster prone areas; environmental impact and risk assessment; building materials, components and construction techniques; and instrumentation for early warning against natural disasters. □

Three Decades of CSIR - DAAD S&T Cooperation

THE Council of Scientific & Industrial Research (CSIR) of India and the German Academic Exchange Service (DAAD) complete 30 years of highly successful cooperation in Science and Technology this September.

The German Academic Exchange Service launched its operation in India in 1950 after India's Independence primarily to promote exchange of scholars between the two countries. The cooperation got a big boost with 100 Yearly Fellowships offered by FRG, when India's former Prime Minister Jawahar Lal Nehru visited the FRG in 1956. DAAD established its office in New Delhi in 1960, which is one of the 12 branch offices of DAAD. The head offices of DAAD are located in Bonn and Berlin. New Delhi office oversees the operations of DAAD in India, Bangladesh, Nepal and Sri Lanka.

A formal agreement between CSIR and DAAD was struck in September 1965 which eventually brought the entire chain of CSIR's 40 laboratories very close to the Scientific and Technological Institutions and Universities in Germany. Under the Scheme of Cooperation, on an average, twelve CSIR scientists annually avail of Short-term German Fellowships for periods of two to three months. More than 360 scientists have already visited Germany so far.

DAAD also offers about 10 to 12 Long-term Fellowships extendable from one to two years, to junior scientists for training in German Institutions. Nearly 250 CSIR scientists have so far benefitted from such trainings leading to the degree of Ph.D. The Scheme also provides for German scientists to visit India for 21 days to three months. Nearly 170 German scientists have so far visited various CSIR institutions. Under the Sandwich Programme, CSIR scientists registered in the Indian Universities for Ph.D. can carry out research alternately in India and Germany under the supervision of an Indian as well as a mentor in Germany. The scheme enables research guides/mentors from India and Germany to visit each others' institutions, in the interest of research project.

The scientist exchange programmes of DAAD result into longer lasting contacts between individual scientists of both the countries which eventually fructify into Collaborative Projects under various bilateral programmes of CSIR with German institutions such as KFA, PTB, DLR and MPG of Germany. The areas of common interest so far for bilateral projects have been aerospace, oceanography, earth sciences, and chemical and bio-process engineering.

CSIR and DAAD propose to host joint workshops on Membrane Tech-

nology, Bio-Technology and Organic Synthesis between September 1995 and September 1996 to celebrate the Three Decades of Successful S & T Cooperation. DAAD programmes also benefit Department of Educa-

tion, Ministry of Human Resource Development; University Grants Commission; Indian Council for Cultural Relations and Indian Institute of Technology, Madras. □

CSIR - Oman S&T Partnership

H.E. Maqbool Bin Ali Sultan, Minister of Commerce and Industry of Sultanate of Oman has invited a delegation from CSIR, India, for two weeks to help Oman in framing a National Science and Technology Policy and R&D Policy; Propose an institutional framework for implementing the proposed national policy including networking with ministries, authorities, private sectors and with the Sultan Qaboos University; Advise on establishment of technology and business incubators for small and medium enterprises; and on S&T collaboration between CSIR, India, and Oman towards setting up of laboratories, contract research, etc.

A four-member team led by Dr Ashok Jain, Director, National Insti-

tute of Science, Technology and Development Studies, as Leader and consisting of Dr V. Prakash, Director, Central Food Technological Research Institute, Mysore; Dr H.R. Bhojwani, Head, Research, Planning and Business Development, CSIR; and Dr H.C. Jain of Shriram Institute of Industrial Research is scheduled to visit Oman for two weeks starting from 20 October, 1995.

This delegation is the outcome of discussions H.E. Maqbool Bin Ali Sultan and other members of the Omani delegation had with the Director General, CSIR, and other senior officials during his visit to India in April, 1995 in connection with the Indo-Omani Joint Commission. □

During wrap-up discussions held at CSIR, the delegation expressed their satisfaction at the visit. The areas of food processing, refined chemicals, molecular biology and biotechnology, leather technology, renewable energy, indigenous medicines and medicinal plants and aerospace were spotlighted as those of prime interest.

To take full advantage of the potential of cooperation between the two sides, it was also agreed that a visit of the CSIR, India, delegation to South Africa should be undertaken, particularly to get acquainted with the expertise and infrastructure of CSIR, South Africa, so as to be able to pinpoint the areas of mutual interest; explore possibility of joint research, technology transfer and S & T business; potential for training; and to carry out ground work for an MoU to be signed between CSIR, India, and CSIR, South Africa.

With the above objectives in view, a five-member team from CSIR, India, is scheduled to visit South Africa starting from 24 October, 1995 for a period of 10 days. The delegation is to be led by Dr K.V. Raghavan, Director, CLRI, Madras, and would consist of Dr B.D.ulkarni, Scientist, NCL; Shri G.A. Krishna, Scientist, CFTRI; Dr D.K. Bhardwaj, General Manager, NRDC; and Shri B.C. Sharma, Deputy Adviser, ISTAD, CSIR. □

S&T Initiative with South Africa

THERE have been very few contacts with South Africa so far especially in the area of Science and Technology. During the first session of the Indo-South African Joint Commission, held in Pretoria during July 1995, the South African side proposed a team to visit India. A five-member delegation visited India during 5 - 21 August, 1995. The delegation held discussions with various Departments and visited number of industrial units in the small scale sector. The main purpose of the visit of the delegation was to familiarize itself

with expertise and infrastructure in the select CSIR laboratories, and recommend to CSIR, South Africa, the possibility of signing an MoU with CSIR, India; and to obtain an exposure to small, medium and micro enterprises and identify areas of technology transfer between the two countries. The recommendations of the delegation will facilitate decision-making on specific areas of technology transfer and cooperation during the forthcoming visit of the Minister of Trade and Industry of South Africa to India which is expected shortly.

Contact Person :
Dr R.K. Bhandari,
Head, ISTAD, CSIR,
Rafi Marg, New Delhi 110 001.
Telephone : (091)11-371-4208/1117/
5241/1134/0512
Telegram : CONSEARCH, NEW DELHI
Telex : 031-65202/66147 CSIR IN
Fax : (091)11-3710618, 3714788, 3711117
E-mail: bhandari@csirhq.ernet.in;
csirhq@aimetd.ernet.in

National Botanical Research Institute, Lucknow

R&D Highlights : 1993-94

DURING the year 1993-94, there has been an effort to consolidate and restructure the research programmes of National Botanical Research Institute (NBRI), Lucknow, in order to maximize the output. A number of research projects were clubbed and some of them were weeded out. All these projects belonged to six major R&D areas, namely, plant biotechnology, floriculture, tree biology, plant wealth utilization, environmental sciences and taxonomy and ethnobotany. Of the eight sponsored projects investigated at the institute, four were sponsored by the Department of Science & Technology (DST), Government of India, and one each by the Ministry of Environment, Wildlife and Forests (MEnF), Government of India, and Ministry of Non-Conventional Energy Sources (MNES), Government of India. The institute generated over Rs 6.6 million from Government agencies for grant-in-aid research projects. Two DBT sponsored projects were completed during the year under report.

The salient achievements of the year accomplished through various R&D endeavours are summarized below:

Plant Biotechnology

The Plant Biotechnology group is working on several aspects of plant molecular biology, biochemistry, virology, UV effect and plant tissue culture. The Centre for Plant Molecular Biology has undertaken work on five projects, viz., (i) Molecular basis of cytoplasmic male sterility in rice and sorghum; (ii) Chloroplast genome organization in *Populus*; (iii) Insect-

pest resistance in crop plants through BT endotoxin and cowpea trypsin inhibitor (CpTI) gene transfer, (iv) Molecular organization of plant viral genomes and raising of transgenic lines of plants with built-in virus resistance; and (v) DNA fingerprinting and analysis of biodiversity in *Amaranthus*.

In the project on molecular basis of cytoplasmic male sterility in rice, studies on the location of 13 genes by oligonucleotide probing of restricted mtDNA of V20A (sterile) V20B (maintainer) lines were carried out. Simultaneously, transcript sizes of seven important genes were also determined by RNA-DNA hybridization. With these studies, polymorphism in V20A and V20B lines with respect to *coxI*, *cob*, *atp6*, *coxIII* and *rps* 14 genes has been established. In sorghum, polymorphism relating to location of several

mitochondrial genes has been demonstrated and characterized in milo-based male sterile, maintainer fertile and restored lines of 2219, 2077, 296 and also ck60 of Indian origin.

The group working on the project 'Chloroplast genome organization in *Populus*', has identified the some clones. Some genes have been fully sequenced and the sequence compared with the same gene sequences of other plants and organisms. Further, the genes, *trnH* and *rps* 19, that are located downstream of *psbA* (sequenced last year), have also been completely sequenced.

A physical map of *Populus* cpDNA with respect to location of IR regions, and location of *psbA*, *psbB*, *psaI*, *psbE*, *psbF*, *psbL*, *trnW*, *trnP* genes and *psbB* operon have been ascertained.



A gamma ray induced mutant of *Chrysanthemum* 'Navneet' developed by NBRI



'Summer prince', an amaranth variety developed by NBRI

The scientists working on the project 'Insect-pest resistance in crop plants through BT endotoxin and CpTI gene transfer' have made two simultaneous approaches using the insecticidal crystal protein gene of *Bacillus thuringiensis* (BT) and the protease inhibitor (CpTI) from cowpea [*Vigna unguiculata* (L.) Walp]. The BT constructs in *Agrobacterium* background were used for agroinfection of tobacco leaf discs and stable transgenic plants were raised. The F₀, F₁ seeds of these plants were collected and tested for insect toxicity under laboratory and field conditions using 2nd and 3rd instar larvae of *Heliothis* and *Spodopoptera*. The F₀ population of BT transgenic was also screened using polyclonal anti-BT endotoxin serum by DAC ELISA and some plants among the F₀ showed positive response over the control plants.

Tissue culture studies on callus formation and multiple shoot induction have been initiated with three varieties of chickpea, viz, BG 267, Pusa 256 and C235.

The group working on molecular organization of plant viral genomes and raising of transgenic lines of plants with built-in-virus resistance, identified two clones of Indian tomato leaf curl virus (ITLCV) as DNA-A and DNA-B. Nucleotide sequencing of the homologous region between these two parts of the ITLCV genome revealed the presence of two putative, divergent, bidirectional promoters and a conserved non-nucleotide sequence which forms a part of the loop of a fairly stable hairpin structure.

For the development of transgenic plants for virus resistance, two

constructs in binary vector containing coat protein gene in sense and antisense orientation have been mobilized in *Agrobacterium tumefaciens*. Tissue culture experiments are in progress to raise transgenic plants.

Yet another group has chosen *Amaranthus* as a test species for DNA fingerprinting and analysis of biodiversity using the institute's germplasm collection. Using oligonucleotide as probes for fingerprinting the studies carried out so far have detected differences between four species of *Amaranthus*.

The biochemistry group has purified and characterized one more enzyme of aspartate pathway, i.e., Homoserine dehydrogenase (HSDH). The native and subunit molecular weights were also determined. Work on the light regulation of aspartate kinase was also continued.

The virology group has carried out studies on biological and immunological characterization of plant viruses. Nucleotide sequencing of a partial clone of *Acalypha* Yellow Mosaic Virus (AYMU) was carried out from both the ends of the fragments using dideoxy chain termination method. The sequencing data revealed that the clone has full length genes for V1 protein, coat protein, AL2 and AL3 proteins. This group has also carried out work to understand the molecular basis of host-parasite interaction between tobacco and cucumber mosaic virus (CMV) and raising of transgenic plants with built-in resistance to CMV.

Yet another group has studied the effect of 25-100% enhanced UV-B on wheat, rice and mustard. With 25% and 50% increase in UV-B, 6.9% and 15.1% reduction in grain yield over the control was observed. This decrease in yield was found to

be accompanied by a decline in net CO₂ uptake, rate of photosynthetic electron transport and RuBP carboxylase activity.

The Tissue Culture group has undertaken work on four projects, three being sponsored by the DBT and one by the institute. The work envisages morphogenetic studies in tissue/ organ cultures of some economic plants aiming at plant improvement, development of methods for fast propagation and creation of variants, apart from germplasm preservation. About 61,000 plants of *Populus deltoides* Marsh were produced at the tissue culture pilot plant facility of TERI, New Delhi, using the techniques developed by NBRI. In *Piper betle* L., procedures for clonal multiplication in var 'Deshi Bangla' by employing single node stem segments taken from field grown vines as well as regeneration of multiple shoot buds from leaf pulvinus callus were developed. A number of plants were successfully processed with cent per cent transplant success.

Floriculture

The projects in the area of floriculture are multidisciplinary and deal with collection, introduction, assessment, improvement, agrotechniques, tissue culture, plant physiology and protection against virus and fungi of ornamentals. As a result of multidisciplinary approach, the scientists of the group succeeded in evolving a golden yellow 'No Pinch No Stake' type small flower of chrysanthemum, namely, 'Swarna Singar'; two gamma ray induced mutants of chrysanthemum, namely, 'Navneet Yellow' and 'Battik'; two *Hippeastrum* hybrids, viz., 'Kiran Rekha' and 'Rupali'; and two attractive foliage amaranth varieties, namely, 'Amar Purple King' and 'Amar Purple Prince'.

As an aid to floriculture the tissue culture group worked mainly on *Gladiolus*, *Monstera*, *Ficus*, *Bignonia*, *Alamanda* and orchids. A woody climber with attractive yellow flowers of *Bignonia chamberlaynii* was cloned in vitro by employing single node stem segments of mature plants. The process has been developed and a batch of more than 50 true-to-type plants were successfully processed and grown in potted soil under glass house conditions.

The Virology group identified the viruses affecting carnation, *Amaranthus* and *Dahlia*. They found that *Amaranthus tricolor* L. and *A. hypochondriacus* Linn. plants were naturally infected by a severe mosaic disease, showing leaf crinkling and stunting symptoms. The disease caused by a virus having close relationship with C&D strains of CMV. The viruses were transmitted by *Myzus persicae* and *Aphis gossypii*. A modified procedure was adopted for raising Chrysanthemum Aspermy Virus (CAV) free plants through leaf culture. Similarly, Cucumber Mosaic Virus (CMV-carnation strain) infecting *Nicotiana rustica* is also being regenerated on virazole treated MS medium.

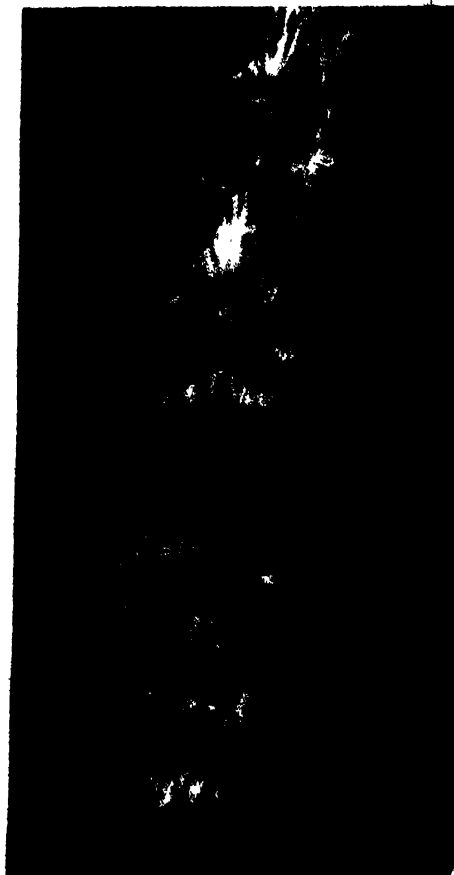
Tree Biology

The Tree Biology group and Biomass Research Centre continued research on indigenous and exotic tree species, varieties and provenances for use in agroforestry and usar site afforestation. In a collaborative study (under MoU with Forest Department, U.P.), a trial of *Acacia nilotica* (L.) Willd. was laid at usar soil site at Kukrail, Lucknow. Selected seedlings were planted without any soil amendment to evaluate performance of the species in degraded forest land. In a similar collaborative

effort, replicated trials of *A. nilotica*, *Syzigium cumini* (L.) Skeels and *Terminalia arjuna* (Roxb.) Willd. were laid at Lucknow University under EPDP programme.

In view of the large scale demand for quality seedlings, the scientists of the Biomass Research Centre conducted experiments to develop techniques for uniform and healthy seedlings. The beneficiaries of seeds and seedlings included Lucknow University; Bihar University, Muzaffarpur; U.P. Forest Department; GEDA, Baroda, etc. A training programme was organized to impart training on the use of biofertilizers, nursery techniques and silvicultural practices for biomass plantations.

The centre is also maintaining cultures of endomycorrhizae from



'Rashmi' – a gladiolus hybrid developed by NBRI

the local soils. These cultures are routinely supplied to nurseries and also provided to users/research organizations. On the basis of protocol developed for microbial carbon estimates, the group has taken a contract project from U.P. Land Development Corporation (through National Remote Sensing Institute, U.P.) for monitoring microbial biomass of selected usar sites of the entire state of Uttar Pradesh.

Plant Wealth Utilization

In the area of plant wealth utilization, the Pharmacognosy group studied the seasonal effect on total alkaloid percentage and variation in the phytochemical constituents of the thick and thin roots of creeping herb, *Boerhaavia diffusa* L. (Punarnava) used as a hepato-protective drug. The alkaloid percentage in the thin roots was higher (0.77%) than the thicker ones (0.15-0.24%). It was also observed that aqueous extract of drug (2 ml/kg) of the thin roots had more hepato-protective activity as compared to its powdered form (150 mg/kg wt.).

The Plant Breeding group continued its efforts to improve the cultivars of opium poppy. NBRI evolved varieties, viz., NBRI-5 and NBRI-6, were found to be quite promising, showing a significantly higher latex yield, i.e., 56 kg/ha and 54 kg/ha.

The scientists of the Betelvine-group continued to improve betelvine cultivation. Further trials using slow release fertilizers over three years indicated that "Nimin" (neem seed extract) coated urea (NCU) at 100 kg N per ha is sufficient to get optimum yield of good quality leaves. Based on the results of foliar analysis surveys covering a total of 320 plantations in parts of Uttar Pradesh and Madhya Pradesh, as also the chemical analysis of leaves under

different treatments of various fertilizer trials, carried out over the past ten years, it was concluded that leaf -N 2.5-3.6, -P 0.24-0.3 and -K 1.85-2.8 per cent dry weight was associated with higher productivity. The group has initiated a research project on silviculture management of bamboos, sponsored by the District Rural Development Agency, Hamirpur. Under the project, experimental plantations of *Dendrocalamus strictus* Nees with poplar clones S7C20 at Banthra and *D. strictus* with *Leucaena leucocephala* and *Casuarina equisetifolia* Amoen at Mahoba have been established. The yield of culms in Mahoba was higher than that of Banthra because of better drainage and management at Mahoba.

The scientists of the Pharmaceutical Chemistry group evaluated extracts of *Mesua ferrea* L. whole flowers, *M. ferrea* stamens and *Ochrocarpos longifolius* Benth. & Hook. flower buds for their pharmacological properties which basically included their effects on cardiovascular system of rats; isolated ileum preparation in collaboration with Department of Pharmacology, K.G.'s Medical College, Lucknow.

The scientists of Natural Polymer group continued their research for new sources of seed gums from several species of leguminous genera like, *Cassia*, *Crotalaria*, *Caesalpinia*, etc.

Environmental Sciences

The scientists working in the Environmental Sciences group investigated the role of plants in indication and abatement of auto-exhaust pollution in Lucknow city. It was observed that all the sites had SPM (suspended particulate matter) more than the permissible level, i.e., 200 µg/m³. In the climatic conditions of Lucknow city,

Polyalthia longifolia Benth. & Hook., *Cassia fistula* L. *Mangifera indica* L., *Thevetia nerifolia* Juss. and *Azadirachta indica* A. Juss. were found to be sensitive to automobile gases, while *Ficus religiosa* Linn., *Bougainvillea* sp. and *Calotropis procera* (Ait) R. Br. were comparatively resistant.

The Aquatic Botany group carried their study on aquatic plants in relation to industrial effluents. Aquatic macrophytes, viz., *Bacopa monnieri* (L.) Wettst., *Nymphaea alba* L., *Spirodela polyrrhiza* (L.) Schleiden and *Hydrilla verticillata* (Linn.f). Royle were selected for bioremedial studies of tannery effluents having different concentrations of chromium. After 14 days of treatment *N. alba* reduced nearly 97% of Cr from raw tannery effluent, while *B. monnieri* could remove ca. 96% followed by *H. verticillata* (81%) and *S. polyrrhiza* (64%).

Taxonomy and Ethnobotany

In the area of taxonomy and ethnobotany, the Angiospermic Taxonomy group conducted studies pertaining to taxonomic revision of the genus *Berberis* based on morphological as well as micro-morphological characters of several parameters. The scientists undertook two collection tours to different regions of Western Himalaya and Arunachal Pradesh in N.E. Himalaya and about 100 field collections of Berberidaceae were made for further study. A new species, viz., *Berberis sanei* Husain et al. was discovered in Arunachal Pradesh. Two undescribed varieties of *Berberis*, viz., *B. petiolaris* Wall. ex. G. Don var. *extensa* Ahrendt Rao et al. and *B. kugawurensis* Royle var. *diversifolia* Ahrendt ex. Husain et al. have also been described. The studies have established that species like, *Eremostachys superba* Royle ex. Rao and *Trachycarpus takil* Becc. are

highly endangered and are confined to solitary locality in Uttar Pradesh.

During the year, ethnobotanical surveys among the Tharu tribe of Gonda and Gorakhpur districts of U.P., were conducted and an inventory of nearly 50 plant species, used by the Tharus for food, fibre and medicine, etc., was prepared.

Nomenclature of 45 illustrations of ferns published by Beddome (1876) was updated by the Pteridophyta group. The scientists were interested in a variable progeny of pentaploid fern, *Pteris vittata* L. Based on its cytomorphological attributes, a new cultivar is being proposed. The Bryophyta group studied sporoderm and elateroderm patterns in some rare and interesting Indian liverworts using SEM.

The Lichen group made investigations on the heavy metal accumulation of Antarctic lichens, *Umbilicaria aprina* Nyl. and *U. decussata* (VIII.) Zahlbr. In another study on the pyrenocarpus lichens, one new species, namely, *Lithothelium himalayaense* from Himalaya was also described.

The pollen morphology of eight wild and five cultivated annual species of the genus *Cicer* (Leguminosae) was studied by LM and SEM for supplementing information for taxonomic consideration and establishing interrelationships among the wild and cultivated species. The seed biology group studied the phenology and floral biology in relation to fruit and seed set in species of *Acacia*, *Albizia* and *Prosopis*, growing on sub-stand-ard soil site.

The scientists of the institute published 91 research papers, presented 54 papers in various symposia, seminars and conferences and published nine popular articles during the year under report. They also

contributed towards two books and 10 chapters in books.

The four national facilities of the institute, viz., Banthra Research Station, Economic Botany Information Service, Botanic Garden and Herbarium continued their specialized services in the area of their activity. A significant achievement of the herbarium has been the amalgamation of the separately kept ethnobotanical herbarium with the main herbarium. □



Second PC Course for CSIR SC/ST staff

FOLLOWING the overwhelming success of the first special course on PC applications for SC/ST staff of CSIR establishments held in April this year, the second course, again coordinated by Shri S. Panchapakesan and his colleagues of CSS, National Aerospace Laboratories, Bangalore, was inaugurated on 21 August 1995. About 25 participants from nine CSIR establishments attended the course.

Dr R. Srinivasan, Head, CSS, welcomed the participants. He told them that while every effort had been made to make the course useful and interactive, real success would only come with regular practice. "It is like driving or swimming; unless you keep practising, you tend to forget", he said. Shri Panchapakesan introduced the course programme which covered DOS, WondStar and dBASEIII PLUS with hands-on training and invited the participants "to take the plunge".

Dr K.N. Raju, Director, NAL, then formally inaugurated the course. "I can't help wondering how much PCs have transformed the way

we work!" said he. In his brief address, Dr B.R. Somashekar asked the participants to "think computers". He explained how the idea of such a course evolved, the reasons for restricting the course to the administrative and SC/ST staff, and advised every one present to take full advantage of the course which NAL has generously subsidised. □



Patent Application No. 290/DEL/95.
A process for the preparation of arsenic modified porous crystalline silicas. Inventors: A. Bhaumik and R. Kumar. National Chemical Laboratory, Pune.

Patent Application No. 291/DEL/95.
An improved process for the preparation of a-chloro-5-(3,4-dimethoxyphenyl) prepionitrile. Inventors: E.G. Hazara, V.S. Pore, P.L. Joshi, N.P. Argade and S. Basu. National Chemical Laboratory, Pune.

Patent Application No. 292/DEL/95.
An improved process for the propynylation of estra-5(10), 9(11)-diene-3, 17- diene, cyclic 3- (1,2-Ethanediy l acetal). Inventors: R.G. Hazra, V.S. Pore and S. Basu. National Chemical Laboratory, Pune.

Patent Application No. 313/DEL/95.
A process for making test paper for testing of iodized salts and test paper made thereby. Inventors: P. Prakash and S. Singh. Central Drug Research Institute, Lucknow.

Patent Application No. 314/DEL/95.
A rigid steel prop with remote release mechanism useful for supporting mine/tunnel roofs. Inventors: A. Dasgupta, A.K. Dutta, M.N. Tarafder and B.B. Dhar. Central Mining Research Institute, Dhanbad. □

New Publication

Switch On the Sun

THE oil crunch that hit the world in 1973 set people thinking that they could not totally depend on conventional energy forms to meet the future power requirements. The inexhaustible sun is now looked upon as a rich source of non-conventional, renewable energy. Fortunately, our country is blessed with climatic conditions which let the sun shine on a large part almost round the year. This abundant source coupled with the progress in solar cell technology has given hope that a solar future is in the making.



Switch On The Sun is an attractive and lavishly illustrated book that describes how photovoltaic cells are harnessing the energy of the sun to

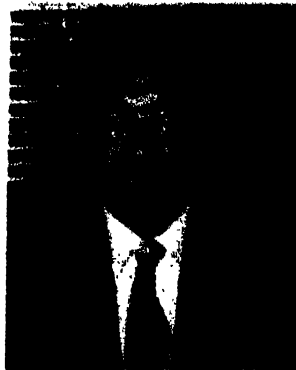
run small pocket calculators to huge power stations. In an easy-to-understand manner the book describes how street lights, community TVs and radios, and water pumping systems operated by solar power are bringing about a rural revolution.

Author: *Tapan Bhattacharya*, pp 124, Price: Rs 40.

Orders for this book should be accompanied by Money Order/I.P.O./Demand draft/cheque, made payable to 'Publications & Information Directorate, New Delhi,' and sent to: The Sales Distribution officer, PID, Dr K.S. Krishnan Marg, New Delhi 110012. □

PIARC establishes World Interchange Network — Prof. D.V. Singh Elected to Board of Directors

PROF. D.V. Singh, Director, Central Road Research Institute (CRRI), New Delhi, has been elected as a member of the Board of Directors of World



Interchange Network (WIN) of Permanent International Association of Road Congresses (PIARC). □

PIARC has a mission to assist the international road community in resolving road related problems, especially in developing and transitional countries, and INTERCHANGE was conceptualized by PIARC C-3 (Committee 3) on Technology Exchange in 1993. The concept was discussed in the Founders' Conference in Casablanca in June 1994 and a vision for a global knowledge network was put forth in a "Declaration of Intent".

The PIARC Executive Committee accepted the offer from Canada-Quebec to take charge of INTERCHANGE Secretariat in collaboration with Belgium and Spain until the XXI World Road Congress (1999). INTERCHANGE now has an International Secretariat in Montreal and both have been recognized by the Quebec International Affairs Ministry. The Organizing Group of INTERCHANGE which took its authority from Casablanca "Declaration of Intent" met on 3 September 1995 at Montreal and adopted the Rules of Internal Regulations of the World Interchange Network (WIN), the formal name now adopted by INTERCHANGE. In this meeting an elected Board of Directors was also constituted. Five of the fifteen Directors on the Board are from non-OECD countries. Prof. D.V. Singh has been elected as a Director to represent the Asian region.

Broadly, the goal of WIN is to serve the practical needs of the road practitioners through the intensified voluntary efforts of institutions and organizations which are WIN NODES. □

Printed and Published by Dr G.P. Phondke, Director, Publications & Information Directorate (PID), Dr K.S. Krishnan Marg, New Delhi - 110 012
Printed at PID Printing Unit

Editors : Dr B.C. Kashyap, Dilip M. Salvi and Madhu Sahni
Phone: 5786301 Gram: PUBLIFORM

Production : Kaushal Kishore
Telex: 031-77271

E-mail: pid@ sirnetd.ernet.in.

Annual Subscription : Rs. 60
Single Copy: Rs. 3.00

Fax: 5787062

CSIR



VOL 45 NO 20 30 OCTOBER 1995

CSIR Directors' Conference

Intellectual Property (IP) policy announced

EMINENT scientists of the country, including Directors of 40 CSIR laboratories, met on 5 and 6 October 1995 at New Delhi to discuss, debate and evolve Intellectual Property (IP) policy and work out a strategy for achieving CSIR vision for 2000 A.D. The conference was inaugurated by Shri Bhuvanesh Chaturvedi, Minister of State for S &

T, and Dr R.A. Mashelkar, Secretary, DSIR, and Director General, CSIR, presided over the meet. Speaking on the occasion, Shri Chaturvedi praised Indian scientists and engineers for their contributions in bringing the benefits of modern science and technology to the people of India, even those in the remotest corners. He assured the scientific community of the Government's continued support and encouragement to the cause of science and technology.

To emerge as a global model of an industrial and self-reliant R&D organization and as a global R&D platform that provides R&D and services worldwide is how the CSIR of 2001 is visualised. The constituents of a draft White Paper covering vital and crucial issues such as a strategy for evolving a plan for new CSIR ; its financial resources management; human capital; re-engineering and management; leveraging alliances; new approaches and strategies for international S&T opportunities; evolving indicators for performance of laboratories and, most impor-

tantly, Intellectual Property policy, were considered. The consensus of ideas reached has culminated in CSIR announcing its Intellectual Property Policy which is the first of its type by any R&D organization and the formation of a detailed White Paper on the New CSIR. Dr Mashelkar elaborated that the IP policy addresses diverse aspects such as generation, documentation, capture and most crucially the tactical management of IP which will enable CSIR to forge strategic alliances and generate business globally. □

IN THIS ISSUE

Integrated Data Acquisition System (IDAS) for Sagar Sampada	307
Regional Research Laboratory, Bhopal R&D Highlights: 1994-95	308
NBRI celebrates CSIR Foundation Day	313
NAL's FEPACS software	314
NCL signs MoU with a Singapore firm	320
National Mineral Award for Dr Purnachandra Rao	320

CSIR Intellectual Property (IP) policy

INDIA's accession to World Trade Organization (WTO) demands not only an urgent attention by the Indian S&T to enhance the levels of innovation and creativity but also to the professional management of Intellectual Property (IP). Also, the strong science base of CSIR needs to be exploited for gaining an economic advantage for the nation. CSIR pres-

ently files and owns more number of Indian patents than any other organization, but its total stock of patents abroad does not compare favourably with the stock held by other similar industrial R&D organizations elsewhere. These perceptions have necessitated the enunciation and communication of an Intellectual Property (IP) policy for CSIR.

Policy statement

The CSIR IP policy would thus be: "To maximise the benefits to CSIR from its intellectual capital by stimulating higher levels of innovation through a judicious system of rewards, ensuring timely and effective legal protection for its IP and leveraging and forging strategic alliances for enhancing the value of its IP".

Goals of IP policy

The goals of CSIR IP Policy are to: (i) stimulate and encourage increased creativity and innovation in CSIR to gain economic advantage; (ii) develop skills amongst the scientists to understand, interpret and analyse the techno-legal and business information contained in patents and other IP documents; (iii) use the information acquired from analysis of IP documents to direct and mount strategic R&D programmes; (iv) establish a globally acceptable system of recording and documentation of experimental results and data; (v) evolve appropriate systems to capture and assess the intellectual property generated in the CSIR system; (vi) provide the highest level of professional techno-legal services for securing and protecting the IP generated; (vii) manage the portfolio of IP as a business activity; (viii) manipulate the patent portfolio, defensively/ and aggressively, to forge strategic alliances/international S&T

collaborations, to gain business advantage/ and ward off competition; (ix) develop the Intellectual Property Management Division (IPMD) of CSIR as a centre of excellence in IP matters; and (x) mobilise and influence national thinking on IP related issues and concerns.

Strategy to implement the policy

The goals of IP policy are to be achieved by: (i) nurturing a strong innovation base in CSIR through a balanced system of recognition and rewards ranging from according due weightage in promotions to monetary and other forms of rewards; (ii) investing liberally to enhance the skills and knowledge base of scientists, through structured in-house and external professional training programmes, some even abroad, on understanding, interpreting and analysing the techno-legal and business information contained in IP documents, and in drafting of IP documents; (iii) identifying and mounting applied research projects after thorough analysis and assessment of techno-legal and business information in related IP documents and monitoring global patent position for mid-term project appraisal for which requisite pre-project budget and funds would be allocated; (iv) establishing and enforcing a formal mechanism of recording and authentication of R&D output/results taking into account the individual characteristics of each laboratory and its activities, that would be accepted and respected by the patenting authorities the world over; (v) encouraging the publication of R&D results in scientific papers after careful consideration of the consequences of IP rights. A quick and effective system at each laboratory would be established to scrutinise the scientific pa-

pers and media releases on achievements/developments proposed in terms of the IP information contained therein; (vi) availing the services of high-class national and foreign consultants and attorneys to advise on and to secure IP rights for CSIR; (vii) monitoring national and international patents and other IP through access to on-line databases, to ensure effective protection and to ward off infringements and threats to CSIR's IP portfolio, and vice-a-versa; (viii) analysing and assessing techno-legal and business information and market intelligence to identify strategic alliances and to exploit potential uncovered niche areas of opportunities and offer on a merchant base value added patent information services; (ix) strengthening the IPMD of CSIR through infusion of qualified and trained staff, empanelment of outstanding consultants and a high-level advisory committee to enable it to develop as a centre of excellence and a national resource for Intellectual Property; and (x) mobilizing public opinion and influencing Government decision/policy on diverse IP issues through analytical and scientific studies taken up in-house or commissioned nationally and internationally and spearheading the movement towards formulating a national IP policy.

CSIR IP Vision 2000

It is envisaged that in 2001, CSIR will hold a valuable portfolio of at least 1000 Indian patents and 500 foreign patents which will enable it to strike strategic alliances with some of the global technological leaders in specific areas and generate at least 5% of its R&D budget from IP licensing/alliances. Its IPMD would be a national resource and international reference centre on IP matters. □

Integrated Data Acquisition System (IDAS) for Sagar Sampada

THE fisheries research vessel *FORV Sagar Sampada* is now equipped with a state-of-art Integrated Data Acquisition System (IDAS) for scientific data collection at sea. The system was developed at National Institute of Oceanography, (NIO), Goa, with financial support from the Department of Ocean Development, and was successfully installed on board *Sagar Sampada* during cruise No. 133, in June 1995. With the introduction of IDAS, bathymetric, navigational, physical, meteorological and acoustic data can be acquired and processed with ease.

IDAS is based on a local area network (LAN) of distributed computers dedicated to data acquisition. A 10 Mb/sec ethernet LAN is used for

real time transactions between data acquisition nodes in addition to providing resource sharing capability. The data acquired by the computers is broadcast on the network so that it can be accessed or monitored from any other computer in the network. This capability offers a truly integrated environment since network-wide data can be monitored in real time from any node.

IDAS computers are interfaced to GPS receiver, ship's log and gyro, echosounders, echo integrator, CTD system, acoustic Doppler current profiler, shipborne wave recorder, sea surface temperature unit and to a shipborne meteorological system developed by NIO.

IDAS runs in a WINDOWS environment with a user-friendly menu driven graphical front end interface. The data acquired is stored on a centralized Novell Netware based file server with 1.2 GB storage capacity. IDAS supports NETBIOS and IPX/SPX protocols for peer-to-peer communication and server access respectively.

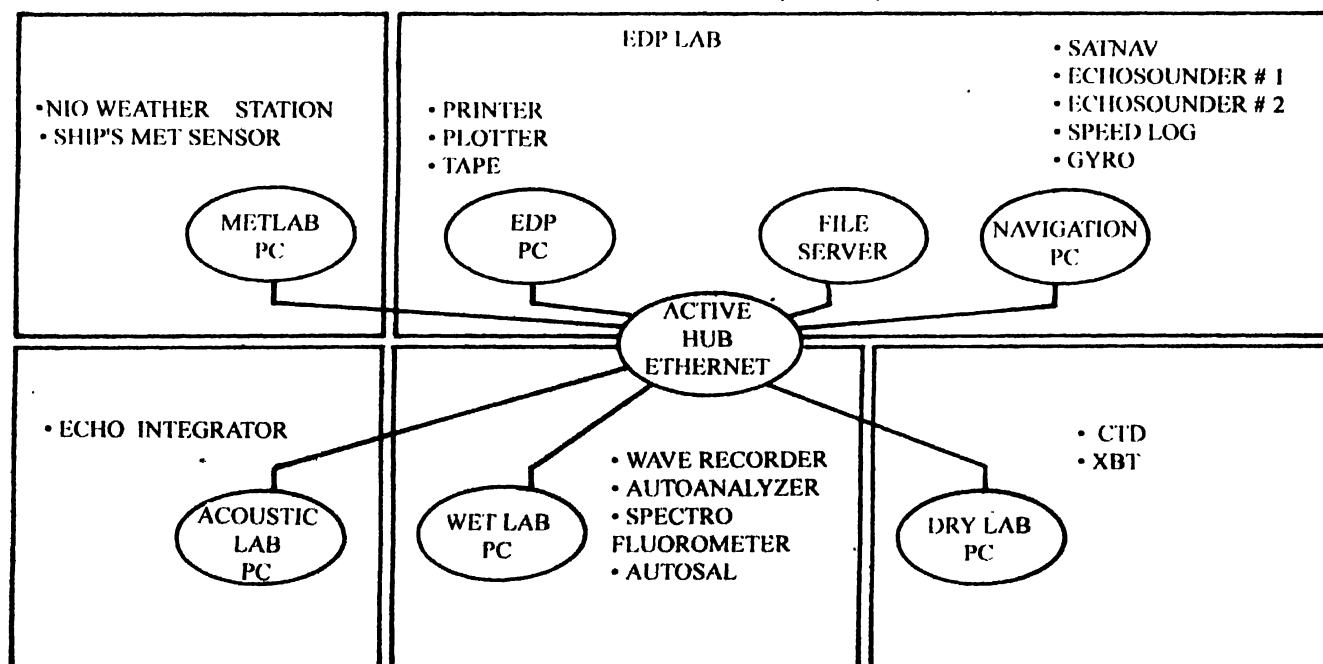
The system includes a general purpose computer with printer, plotter and other peripherals for data processing. The present network of eight computers can be easily expanded to accommodate additional systems in future. □

2 MW S - Band Tunable Pulsed Magnetron

A conventional unpackaged water-cooled glass version mechanically tunable pulsed magnetron with minimum peak power output of 2 MW in S-band has been developed by Central Electronics Engineering Research Institute (CEERI), Pilani, under the grant-in-aid from Department of Atomic Energy. The major specifications of the tube are as follows:

Peak power out- : 2.0 MW
put (minimum)

Frequency : 2998 MHz



Integrated data acquisition system for *Sagar Sampada*

Tuning range : 10 MHz
(minimum) (2992-3002-MHz)

Peak anode voltage (typical) : 43 kV

Peak anode current (typical) : 100 A

Pulse width : 4 μ sec

Duty ratio : 0.001

This is a multicavity conventional magnetron having 12 hole and slot

cavities with echelon strapping system and an indirectly heated mushroom version oxide-coated cathode. The generated RF power is coupled out from the back of one cavity by means of two symmetrical loops mounted at its each end and launched into a circular waveguide.

The developed magnetron has passed user trial tests meeting all the required electrical and mechanical specifications with peak power output of the order of 2.4 MW in tuning range of 2987 to 3002 MHz. Centre

for Advanced Technology, Indore, has participated in its performance evaluation.

This magnetron has been developed for use as an RF source in electron accelerators - Microtron and LINAC systems. These systems find application in radiotherapeutic treatment of cancerous tumours, nuclear power, ship building, armament and space industries for X-ray radiography of metallic and non-metallic components. □

Regional Research Laboratory, Bhopal R&D Highlights: 1994-95

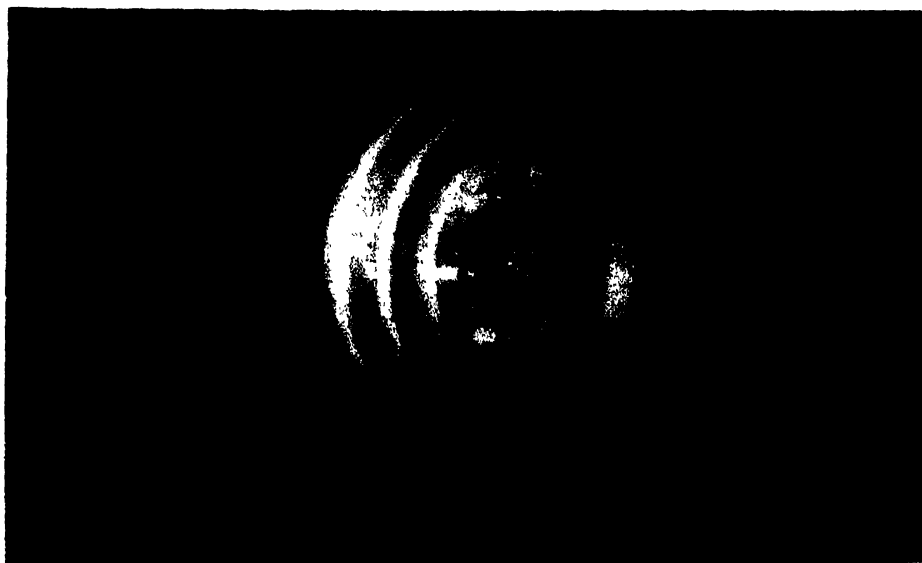
DURING 1994-95, the following significant developments took place at Regional Research Laboratory (RRL), Bhopal: (i) Efforts were made to functionalise products and processes developed by the laboratory through active association of user industries and agencies; (ii) Interactions with the Government of M.P. on S&T input to

regional problems were actively held; and (iii) Scientific and technological capabilities and infrastructure were consolidated.

The laboratory sustained an appreciable level of external cash-flow of Rs. 13.2 million. Significant amongst technology/product developments have been the fibre reinforced plastic (FRP) gear cases for

traction motors of locomotives, the wood substitute products, introduction of washing techniques like Vorsyl Separator for coking coal in an operating plant and metal matrix composites (MMCs) for automotive components and other applications.

FRP gear cases have undergone over ten months of field trials in South-Central Railway. M/s Permali Wallace Ltd., Bhopal, has been assigned this technology for commercial production. Building Materials Technology Promotion Council (BMTPC) is guiding the efforts of marketing the wood substitute products developed by RRL. Prompted by the success of Vorsyl Separator installed by TISCO at its West Bokaro Washery, the laboratory has attracted more projects in this area leading to industrial applications of the technique. Similarly, ceramic fibres preforms, MMC brake drums, modified mining implements, farming implements, and tribo-components developed by RRL have been subject to elaborate performance evaluation and field applications with encouraging results. A project on



RESCA brake drum fitted on Nissan Jonga jeep

'Fertilizer Minerals of M.P.' supported by Department of Mines has been completed and a detailed project report with techno-economic assessment is available.

Pilot project on wasteland development through flyash utilization at NTPC, Rihandnagar, is nearing completion. The project has provided a strong basis for embarking on project related to bulk utilization of flyash in land reclamation at other sites in vicinity of power plants in the country.

The laboratory is helping in coordination and tie-up of CSIR laboratories with the Rajiv Gandhi S&T Missions launched in M.P. Major inter-lab collaboration is expected with NEERI, CLRI, CBRI and IICT with reference to Watershed Mission, Advanced Technology Mission and Rural Industries Mission of the State Government. RRL has initiated activities in environmental studies with specific reference to local needs.

Involvement of a host of agencies such as State Government, UNICEF and NABARD in the projects on groundwater resources management is an indicator of the interest evoked by RRL in this vital area. RRL is associated with the Rajiv Gandhi Watershed Development Mission in carrying out preparation of watershed maps and thematic maps.

Major activities related to research support and technical advice were undertaken for State Electricity Boards, industries and other agencies. These included specialized technical services in terms of materials evaluation and characterization, engineering failure analysis, and component life extension studies. A centre for characterization of building materials being set up with the support from BMTPC, DST and CSIR has already started attracting a variety of materials evaluation assignments.

Six agreements for collaborative projects and technology transfers have been signed during the year; three of these agreements are with prestigious industries around Bhopal, namely, M/s Permali Wallace Ltd., M/s Bharat Zinc Ltd., and M/s Elcaps Ltd. Some significant R&D achievements of the laboratory during the period under consideration are as follows:

Wasteland development at NTPC, Rihandnagar

Rihandnagar Super Thermal Power Project (Rh. STPP) is one of the central sector undertaking power plants located at south eastern tip of Uttar Pradesh. This power plant generates 1000 MW power from two units of 500 MW each. While generating power the plant releases huge quantity of ash during the combustion of coal. This is a potential source that can lead to ecological and environmental degradation. Also a large area of valuable land is occupied for dumping the flyash.

During the year 1994-95 project activities were carried out at a Nilgiri site and a Dodhar site, covering an area of 15 acres. Thirty five thousand tons of flyash was used for reclaiming land and 265 ton/acre of ash was mixed for soil amendment.

The flyash-filled area was covered by spreading soil to a thickness ranging between 30 and 50 cm and was further conditioned. Improvement in plant growth, better crop yields of cereals, vegetable crops, etc., have been observed. The observations of the first three cropping rotations show that: (i) the yield increased from 16 to 58 % more in ash mixed sites; and (ii) 20 to 30% irrigation water is saved with the application of ash mixing.

Major Facilities at RRL-Bhopal

REGIONAL Research Laboratory, Bhopal, has modern equipment and instrumentation for chemical analysis, mineral processing, mechanical testing and metallography in addition to well-equipped foundry, workshop and library. The equipment include: Scanning Electron Microscope, X-ray Diffractometer with PC-APD software, TAS Plus Image Analyzer, Atomic Absorption Spectrometer, DCP Spectraspan, Simultaneous Thermal Analyzer, Particle Size Analyzer, INSTRON Universal Testing Machine, Stress Rupture Testing Machine, Friction and Wear Testing Machine, Rubber Wheel Abrasion tester, Gas Jet Erosion Tester, Bearing Test Rig, Talysurf Apparatus, Fatigue Testing Machine, Pressure Die-casting Machine, Melt Spinner, 150 T Hydraulic Press, High Temperature Furnace, Plasma Spray Unit, Computerized Hysteresisgraph, Mozely Hydrocyclone, Wet High Intensity Magnetic Separator, Mozely Mineral Separator, Mozely Vanner, Mozely Multi-Gravity Separator, Wilfley Table, Water-only Cyclone, Heavy Media Cyclone, Vorsyl Separator, Flotation Cells and Columns, Air-sparged Hydrocyclone, and computer facilities. □

Products grown in ash mixed site have been tested at Industrial Toxicological Research Centre, Lucknow, and Central Food Technological Research Institute, Mysore. The toxic element/heavy metal uptake by vegetables and fruits have been

Building Materials Characterization and Testing Centre

THE Building Materials Characterization and Testing Centre at Regional Research Laboratory, Bhopal, is being equipped with modern facilities, and is being set up with financial assistance from BMTPC, DST and CSIR. The centre has started attracting a variety of characterization and evaluation assignments from industry and other agencies.

The centre has been established to expand base for characterization and certification of existing/new alternate building materials to cater to the needs of various construction agencies, e.g., CPWD, Railways, MES, Housing Boards, State PWDs and other construction and manufacturing industries. In view of the liberalization of economy and incentives to utilize industrial wastes by Central Government many new products are coming in the market which

require performance evaluation and subsequently certification.

With a view to provide above services, advanced facilities and testing equipment have been acquired: Universal Testing Machine (200 T capacity); Non Destructive Testing Equipment; Flexural Testing Machine (100 KN capacity); Plate Bearing Test Apparatus; Door Shutter Testing facility; Weatherometer; Pile Integrity tester; and Salt fog and humidity cabinet.

In addition, auxiliary equipment are also available. The centre can undertake characterization and evaluation of a range of materials: cement; concrete; aggregate; metals; plastics; stone; bricks; tiles; timber/substitute products; doors; soils; foundations; paints and protective coatings.

weighs 130 kg. Six cases are used in a locomotive.

Low carbon steel is also susceptible to corrosion and failures in the weld joints leading to the leakage of lubricant. The heavy weight of the steel gear case sometimes causes its detachment from the traction motor due to violent jerks and/or impact which is very common for locomotives. The light weight and corrosion-free FRP gear case is expected to offer several advantages over the conventional steel gear case.

Squeeze cast components

Trials on Squeeze Infiltration of Al-alloy into the preforms of SiCw and of alumino silicate short fibre with varying range of volume fractions were successfully conducted. It is now possible to achieve 60 mm squeeze infiltrated length using optimized key process parameters.

Country wide survey was made to identify the organizations having facilities of rolling and extrusion. BARC, Bombay, has offered their facilities and expertise in these fields. Rolling of a few ingots made by squeeze infiltration technique has been conducted. BARC is, however, interested in getting ingots of rectangular shape for this purpose. The placement of order for fabricating die suitable for obtaining rectangular ingots is in progress. BARC has also agreed to extend their facilities of extrusion. Ingots have been supplied to them. Mechanical properties have been improved by 20% over gravity cast metal matrix alloys. Results have been communicated to VSSC, Trivandrum.

found to be well within the tolerance limits.

The micro and macro nutrients present in soil sample were analysed by Direct Current Plasma Spectrophotometer, Iron Selective Electrodes and Atomic Absorption Spectrophotometer. The pH value was determined calorimetrically and the mineral phases of samples was determined by X-ray Diffractometer.

FRP gear case for traction motors

An indigenous fibre reinforced plastic (FRP) gear case has been jointly developed by RRL, Bhopal, Permali Wallace Limited, Bhopal, and BHEL,

Bhopal. This gear case is proposed for traction motor (TM 4906 AZ) of Broad Gauge Diesel Locomotives for use in Indian Railways.

The FRP gear cases have undergone over ten months of field evaluation by RDSO in the South Central Railways. Nothing adverse has been reported. RRL has transferred the technology to M/s Permali Wallace Ltd.

Fabricated from low carbon steel St-42S by welding and bending of sheets of 6-8 mm thickness, the conventional gear cases require lifting facilities for mounting and demounting for greasing and for other maintenance work. FRP gear case weighs 78 kg compared to the steel case which

Alumino-silicate short fibre preforms

A number of trials of milling and washing were conducted using mineral beneficiation techniques in order to obtain highly dispersed fibre with shot content of less than 0.01%. Milling trials were conducted using rod mill and ball mill in dry as well as in wet condition. It has been found that step melting in wet condition using rod mill gives better control over fibre length which is the most important factor for controlling preform volume fraction.

Washing trials were conducted using the technique. The fresh water rate, feed rate, slurry composition, stroke length, speed and slope of table have been optimized in order to obtain shot content less than 0.01%.

Preform crushing strengths were determined, following ASTM standard method, using 1 ton "Instron Testing Machine". It was observed that these preforms satisfy the strength (i.e. 1 MPa) as desired by General Motors, USA.

RESCA brake drum

Al-alloy hard particle composites were prepared at RRL for making brake drum for Maruti van and components for mineral dressing equipment. Metallic moulds for Maruti van has been made by the collaborator M/s Rasmi Die Castings Ltd., Secunderabad. The brake drum for Maruti van will be cast at M/s Rasmi Die Castings Ltd., Hyderabad. M/s Bajaj Auto Ltd., Pune, has shown interest in development of cylinder block using MMC. The RESCA brake drum has been tested in a Nissan Jona Jeep at VRDE, Ahmednagar, for a period of 2500 hrs.

Services offered by RRL-Bhopal

CONSULTANCY services and technical services comprising testing and analysis, training, assistance of advisory nature, etc., have been extended to industries. Major areas are specialized materials testing, engineering failure analysis, building materials characterization, minerals processing, environmental impact assessment, environmental auditing, safety auditing, hydro-geological investigation, effluent treatment plant design, and user specific software development. The clientele of RRL-Bhopal includes MPEB, NFL, TISCO, BHEL, EPCO, NMDC, UNICEF, OTL, Lupin Labs, and many industries in the region. □

Mining implements

Under the project on improving the life of mine implements, sponsored by the Ministry of Coal through CMPDIL, two implements, namely, shovel teeth and deck plate of AFC pan, were investigated.

After laboratory scale investigation on presently used implements and various alternate grades of steel, a few compositions were selected for the manufacture of shovel teeth. Prototype shovel teeth of these compositions have been made at M/s Trishul Castings, Bhopal. Field trials of the newly developed implement are in progress at mining sites at Rajappa in Bihar and SECL in Bilaspur.

A few available grades of steel having the potential for use as the pan material were studied at the laboratory. It was found that the same can be used as pan after subjecting them to proper heat treatment. Further, a number of appropriate hard facing electrodes suitable for deck plates were evaluated for their wear resistance at the laboratory. On the basis of the results obtained, one composition was selected and hard facing of the pans was carried out at site. Field trials are in progress.

Upgradation of agriculture implements

Tillage, harvesting and weeding agricultural tools are generally fabricated out of mild and medium carbon spring steel scrap. The material quality and therefore life of the implements is poor. Primary tillage implements such as duck foot cultivator, shovel reversible and mould board plough were processed and fabricated at RRL.

In case of duck foot cultivator, reduced scouring and about 40% less material loss due to abrasion was noted. Field trials on shovel revers-



Multigravity separator for heavy minerals

ible and mould board plough field test trials were being carried out at Tamil Nadu Agricultural University, Coimbatore. Test soils included black sandy clay loam, red sandy clay loam, black clay (wetland) types.

Leachable manganese oxide from pyrolusite ore

In the secondary zinc recovery process by electrochemical deposition, dissolved Mn (II) is used as additive iron in the cell. M/s Bharat Zinc Ltd (BZL), Bhopal, approached RRI for development of a process for this purpose. The laboratory scale process with above 90% conversion of the available manganese in the ore was developed by the laboratory. Based on these results, M/s BZL has requested the upscaling of the process to pilot plant scale. This part of work is in progress. The project has been sponsored by M/s BZL.

Low ash coking coal by Vorsyl Separator

At West Bokaro site of TISCO, a 400 mm Vorsyl Separator was installed on the recommendation by RRL. During 1994-95 the laboratory has got a constant feedback on the performance of the unit. It has been reported that this development signifies extra 50 tpd of clean coal (17.3 % ash) without any additional costs. Coal India Ltd. has shown keen interest in this development and has a sponsored project with RRL. Installation of industrial scale Vorsyl Separators at other coal washeries in the country will generate necessary confidence to facilitate adoption of this technique.

Scale-up studies on water-only cyclone

The project was initiated jointly by RRL and Indian School of Mines,

Dhanbad. The main objectives of the work are: (i) Carrying out experiments in the laboratory using water-only cyclones of different diameters on coals from Jharia and Madhya Pradesh; (ii) Performing experiments (to the possible extent) at the plant scale level to analyse separation efficiency of water-only cyclones; and (iii) Critical analysis of effect of design and operating variables on the performance of water-only cyclones (of both laboratory and industrial size).

From the tests on 76 mm water-only cyclone it is evident that the Monodih coal fines can be efficiently beneficiated using a water-only cyclone where the yield of clean coal upto 71.58% can be obtained with ash content of 17.37%.

Water-only cyclone at Jamadoba washery

The objective is to establish the efficacy of water-only cyclone for beneficiation of Jamadoba coal fines (0.5 mm) as an alternative to froth flotation.

Presently, froth flotation is being practiced to treat the coal fines at Jamadoba washery. Though flotation is an efficient process, it becomes very costly when compared to simple gravity concentration process. Water-only cyclone is an effective technique for treating coal fines and hence it has been suggested for the studies.

If the water-only cyclone is found suitable and the existing flotation process is replaced there will be significant savings from power consumption, lower maintenance cost, higher capacity per unit area, reagents cost, etc.

Artificial recharge studies in Dhar district, M.P.

The project is sponsored by UNICEF to carry out geomorphological investigations, monitoring of ground water levels and designing of site specific water conservation structures.

In the first phase, a detailed field survey was conducted in 24 villages of Sardarpur and Badnawar blocks, to understand the local geology and to identify topographical features. Base maps were prepared using Survey of India toposheets on 1:50,000 scale for both blocks indicating observation stations and drainage network of the study area. Water table contours were also plotted on the basis of collected water table levels in the field. Based on the satellite data, thematic maps for land use/land cover and hydrogeomorphology have been prepared for both the blocks.

Groundwater quality studies at Reliance Petroleum Ltd., Jamnagar

This is a collaborative project with NEERI, Nagpur, and involves development and analysis of technological options in case of contamination of groundwater by any one of the chemicals with the help of mathematical modelling.

Investigations were undertaken to define the geology and hydrogeology of the local area and assessment of present status of water quality of groundwater and nearby surface water. Eventually, demarcation of contamination zone likely to be influenced by the chemicals of hazardous waste of dump and leachates from the proposed dumping site is aimed at.

The water samples collected from the field have been analysed for various parameters. The total dissolved



solids (TDS) and chloride concentrations are the most important from the point of view of salinity. The TDS increases in NNW direction where sea water intrusion is prominent in the upper aquifer. Similarly, TDS mounds are also observed west of Motikhavadi village where two prominent ridge dykes are crossing each other. To understand the contaminant behaviour of the proposed refinery at the study area a two-dimensional contamination model was prepared. The model inputs include hydrogeological parameters, effective porosity distribution, background concentration, probable sources and strengths of pollutants. The model output included areal and temporal distribution of water quality in aquifer.

Proposed hazardous waste disposal site at Mannellure, Tamilnadu

The project is taken up with collaboration of NEERI, Nagpur, and involves development and analysis of technological options in case of contamination of groundwater by any one of the chemicals with the help of mathematical modelling. The study area is covered by lateritic and calcareous sedimentary formations of quaternary period. This formation is followed by a sandy aquifer of tertiary period at a depth.

A three dimensional finite difference groundwater model is applied to the study area. In this model the inter stream region between two nalas passing below and above Mannellure village has been considered as a boundary on south, east and north sides. And an imaginary boundary from Satyaveedu village to Egmmadurai village is considered as western boundary. The first aquifer, i.e., the unconfined aquifer having about 8 m thickness and the bottom

aquifer of 30 m thickness is considered for modelling. The model output indicates the groundwater position in the study area.

To understand the leachate migration below the proposed site a two-dimensional contamination model was prepared. The model inputs include hydrogeological parameters, effective porosity distribution, background concentration, probable sources and strengths of pollutant. The model output included areal and temporal distribution of water quality in aquifer. □

NBRI celebrates CSIR Foundation Day

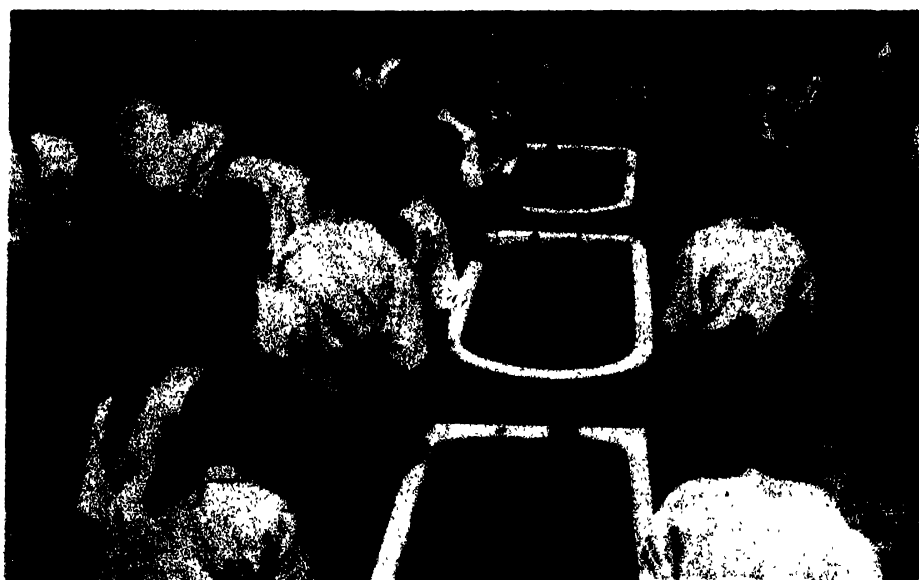
THE National Botanical Research Institute (NBRI), Lucknow, observed the 'Open Day' on 26 September 1995 to commemorate the Foundation Day of the Council of Scientific & Industrial Research. On this occasion, the various laboratories, botanic gardens, herbarium, exposition, library and Banthra Research Station of the institute remained open to the public. High-

lights of the occasion were screening of science films for school children, 'Science essay contest' for the children of NBRI staff, special demonstration of the salient technologies developed by the institute, special display of significant achievements of NBRI and reprints of scientific research papers published by the scientists of the institute in journals during 1994-95, and the significant achievements of NBRI were also displayed. A large number of students accompanied by their teachers and the public at large visited the institute on this occasion.

Besides, 36 prizes were also awarded to the young winners of science essay contest held in the institute at a special function held in the evening. Dr P.V. Sane, Director, NBRI, gave away the prizes to the winners. □

Workshop on Mass Spectrometry

THE 7th National Workshop on Mass Spectrometry (7th NWMS) was held during 21-25



Students visiting the Aquatic Botany Laboratory of National Botanical Research Institute, Lucknow, during the 'Open Day' held on 26 September 1995

NAL's FEPACS software

THE Siddaganga Institute of Technology (SIT), Tumkur, Karnataka, has recently acquired the computer software package called FEPACS from National Aerospace Laboratories (NAL), Bangalore. FEPACS is an effective and reliable analysis tool for static, dynamic, buckling and thermal analysis of structures such as are used in aerospace, automobile, civil, mechanical, electrical, nuclear and ocean engineering. The package contains the most efficient state-of-the art one, two and three dimensional beam, plate, shell and solid elements. It is portable and adaptable on PC work stations and supermini platforms. In SIT, it is now available on the UNIX network at their Aryabhata Computer Centre.

With the acquisition of this package, SIT faculty and students will now be able to undertake complex research, development and consultancy projects in a wide range of engineering disciplines. SIT and NAL also envisage joint programmes for further enhancing the software package. NAL scientists Dr Gangan Prathap and Dr B.P. Naganarayana conducted a six-day workshop of lectures, tutorials and hands-on sessions using the FEPACS package on site at SIT during 4-9 September 1995 to familiarize their faculty on the use of the package. □

August, 1995 at Regional Research Laboratory, Thiruvananthapuram (RRL-T). It was organized jointly by Indian Society for Mass Spectrometry and RRL-T. The theme of the workshop was 'Advances in Mass Spectrometry: Instrumentation and Applications'. The workshop was in-

augurated by Dr A.D. Damodaran, Director, Regional Research Laboratory, Thiruvananthapuram, and presided over by Prof. S. Ranganathan, Emeritus Professor, INSA Senior Scientist, Biomolecular Research Unit, Regional Research Laboratory, Thiruvananthapuram. In the keynote lecture Prof. Ranganathan traced the development of mass spectrometry from the earliest times of Aston to the present and projected its future potential. Thirty five delegates from all over the country participated in the workshop from R&D institutions like Bhabha Atomic Research Centre (BARC), Bombay, Indira Gandhi Centre for Atomic Research (IGCAR), Kalpakkam, Indian Institute of Chemical Technology (IICT), Hyderabad, Vikram Sarabhai Space Centre, Thiruvananthapuram, and private industries working on spices, pharmaceuticals and pesticides, and universities. The faculty members were from BARC, IGCAR, IICT, National Geophysical Research Institute, Hyderabad, Atomic Mineral Division, Defence Research Development Establishment, and Birbal Sahni Institute of Paleobotany, Lucknow. The workshop was co-ordinated by Dr C.S. Narayanan, Dep-

uty Director and Head, Spices Processing and flavoring Technology Division, Regional Research Laboratory, Thiruvananthapuram. □

CMRI meets Manufacturers

ON 25 May 1995, some Calcutta-based manufacturers as well as suppliers of hazardous area equipment were invited by Central Mining Research Institute (CMRI), Dhanbad, to a local hotel for a face-to-face discussion with them on its testing services. Earlier, similar meetings were also organized twice in Bombay in the recent past. The purpose of the meeting was to know whether the beneficiaries of the testing services have any grievances or whether they want any new service or any other information that would make the testing services more user-friendly.

Prof. B.B. Dhar, Director, CMRI, who chaired the meeting, welcomed the participants and expressed his willingness to extend all possible help to the users of CMRI testing services.

Shri J. Achari, Scientist, and Head of the Flame & Explosion Laboratory,



Prof. Bharat B. Dhar, Director, CMRI, addressing manufacturers and suppliers of hazardous area equipment at the 'CMRI-Manufacturers Meet'

made a brief presentation outlining the background, present activities and future plans of CMRI Testing Cell. The participants joined the subsequent discussions and expressed their satisfaction over the existing functions of the CMRI Testing Cell. Some insisted that CMRI should introduce mechanical tests facility for conveyor belts as per IS specifications. The propane burner testing facility for conveyor belting has recently been commissioned in the institute.

At the end, Dr C. Bandyopadhyay, Scientist-in-Charge, Testing Cell, summarized the proceedings of the meeting and Shri S.K. Das, Scientist, proposed a vote of thanks. □

CBRI - Entrepreneurs Meet on EPS Shutters

A one day 'CBRI - Entrepreneurs Meet on EPS Door Shutters' was organized by the Central Building Research Institute (CBRI), Roorkee, on 27 July 1995 at Roorkee. About fifty participants including 18 entrepreneurs, scientists from RRL-Bhopal, officials from CSIR Headquarters and CPWD attended the meet. In his inaugural address Prof. R.N. Iyengar, Director, CBRI, highlighted the work being done at the institute as well as in other CSIR laboratories on wood substitutes under CSIR Thrust Area Programme. As a fallout of this programme two useful alternatives to traditional door shutters have been developed successfully, and more alternatives to wood are in the pipeline. Development of EPS Door Shutter at CBRI is one of the success stories of this programme. The objective of the meet was to motivate the entrepreneurs to take up the process know-how for the manufacture of EPS door shutters, and to discuss and sort out the



Dr N.S.Bhal, Deputy Director, CBRI, Shri S.D. Garg, Advisor, S&T Mission, CSIR, Prof. R.N.Iyengar, Director, CBRI, and Dr L.K.Agarwal, Head, OBM Division, CBRI, at the CBRI-Entrepreneur Meet held at Roorkee

teething problems that the manufacturers and user agencies may face. During deliberations the following lectures were delivered: (i) CSIR thrust on wood substitute by Shri S.D. Garg, Advisor, S&T Mission, CSIR, New Delhi; (ii) Salient features of EPS door shutters by Dr K.K. Ashtana, Scientist, CBRI, Roorkee; and (iii) Future R&D efforts on wood substitute by Dr. L.K. Agarwal, Scientist Coordinator, CBRI, Roorkee.

A visit to the laboratories of the institute was also arranged to show the participants the on-going activities on the development of wood substitute materials, as well as testing and evaluation facilities available in the institute.

In the concluding session the discussions were focussed on the following major issues: (i) Reduction of the cost of EPS Door shutters by 15-20 per cent; (ii) Closer interaction amongst the institute-entrepreneurs-user agencies for the speedy adoption of newly developed wood substitute material, (iii) Waiving off excise duty on the wood substitute

on door shutters; and (iv) Need for the development of more new products which can be used as wood substitute for various applications in buildings. □

Training Programme

Alternate Housing Technologies

THE Central Building Research Institute (CBRI), Roorkee, organized a 5 day training-cum-demonstration programme at Guwahati from 18 July to 22 July 1995 on "Alternate Housing technologies for Assam" in collaboration with Assam Science, Technology and Environment Council (ASTEC). The programme was designed with a view to create awareness among engineers, architects, builders, entrepreneurs and decision makers of North Eastern states about the recent developments in building technologies, materials and low cost sanitation and to generate skilled

manpower in innovative building technologies suitable for housing in earthquake/flood prone areas.

Shri S. Condpan, Minister, PWD, Assam, inaugurated the programme which was attended by 77 participants comprising practising engineers, architects and officers from Assam PWD, Housing Board, Electricity Board, Police Housing Corporation, Industrial Development

Corporation, Refinery, HUDCO, Regional Building Centres and ASTEC, lecturers from civil engineering departments of various engineering institutions at Guwahati, entrepreneurs and builders.

The participants underwent training through lectures, live demonstrations, audio visual presentations and deliberations. The programme covered the following

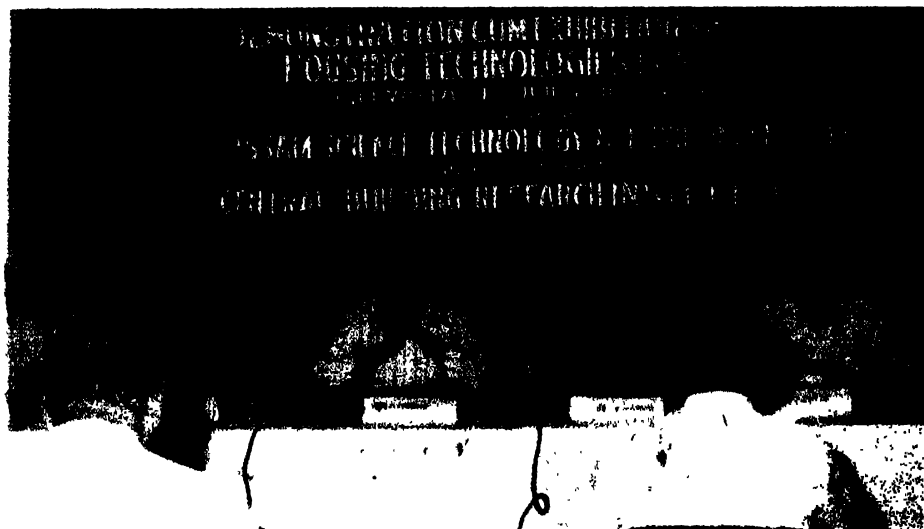
topics: (i) Cost effective and appropriate technologies for foundation, walling, intermediate flooring/roofing for urban areas; (ii) Quality assurance aspects in building construction; (iii) Earthquake resistant measures for engineered and non-engineered constructions; (iv) Improved rural houses and sanitation; (v) Houses for flood prone areas; (vi) Innovative building materials; and (vii) Energy (active & passive) efficiency in buildings.

Live demonstrations covered the following subjects: (i) Stone masonry blocks and solid concrete blocks for walling; (ii) Precast RC thin lintels and lintel cum *chhajjas*; (iii) Channel unit for flooring/roofing; (iv) RC blanks and PP joists for flooring/roofing; (v) L-pan units for sloping roofs; (vi) Prefab brick panels for flooring/roofing, and (vii) Non-erodable mud plaster for mud walls and traditional bamboo walls

The programme was supplemented with group discussions and screening of the following films: (i) *Under One Roof*, a film on the infrastructure and expertise of CBRI; (ii) *Mile Stones*, a film on the infrastructure and expertise of CBRI; (iii) *Innovative Block Masonry*, a training film on innovative walling technology; and *Low Cost Housing*, a film on cost effective construction technologies.

An exhibition depicting innovative building materials and construction technologies was also arranged during the programme. More than 200 persons witnessed the exhibition every day.

Shri S. Chakraborty, Secretary, Town and Country Planning, and the Chief Guest of the valedictory function, gave away certificates to the trainees. The programme was effective in creating interest in some of the CBRI technologies in Assam. □



Inaugural session of 'Demonstration cum Exhibition of Alternate Housing Technologies for Assam' in progress



A demonstration of CBRI technologies in progress at Guwahati, Assam

Development, Construction and Extension

AT the request of the British Council, British High Commission, New Delhi, Central Building Research Institute, (CBRI), Roorkee, arranged a training programme on 'Construction of School Buildings in Andhra Pradesh' from 24 July to 31 July, 1995 at Water & Land Management Training & Research Institute, Hyderabad. The programme was aimed at providing detailed theoretical and practical training to 32 engineers drawn from the Panchayati Raj Department of AP. It covered techniques selected by British Council for construction of primary school buildings in AP. The programme was therefore designed to impart indepth training in the selected techniques.

The programme included detailed deliberations and complete field demonstrations from selection of material to casting, handling and assembling of precast components, site and construction management, quality assurance, etc. It was adequately supported by technical lectures and audio visuals like slides and video films.

Following lectures were delivered by CBRI scientists: (i) Planning, design and construction of primary schools; (ii) Project planning and construction management; (iii) Feedback and practical problems in construction of school buildings; (iv) Appropriate construction technologies for construction of buildings; (v) Construction of school buildings with precast channel units; (vi) Implementation of CBRI technologies in Andhra Pradesh; (vii) Construction of school buildings with RC planks and joist scheme; (viii) Precast concrete block masonry; (ix) Concrete and its

ingredients; and (x) Production and quality control of precast roofing and walling units in field.

The above lectures were followed by live demonstration of prefabricated construction techniques, i.e., concrete blocks, channel units, RC planks and joists and precast thin lintels, in a step by step manner from casting to complete erection.

The programme ended with a test followed by detailed technical discussions to ensure that the trainees have clear conception about the new techniques and are able to take right decisions in different field conditions. □

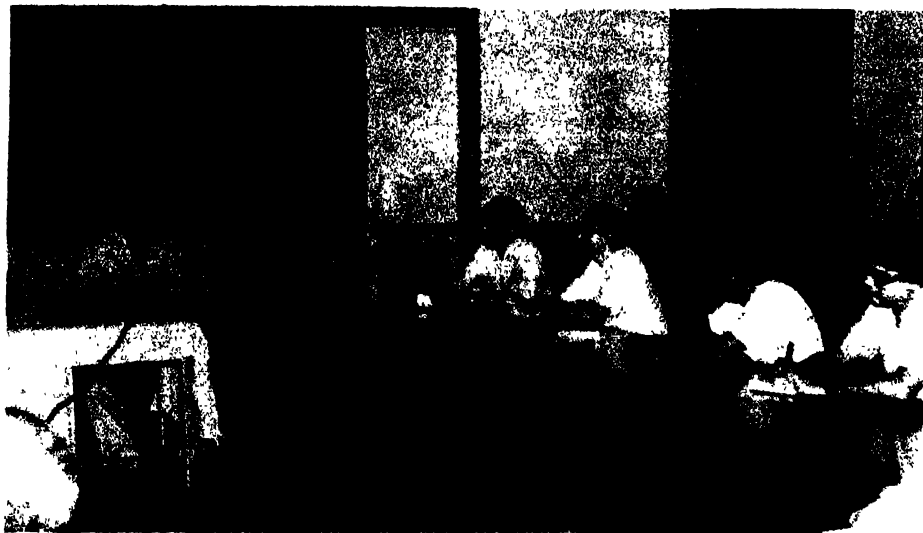
Training Course

R&D Management at CGCRI

A two-day lecture course on 'Management Development in R&D Labs' was organized during 20-21 July 1995 at Central Glass & Ceramic Research Institute, (CGCRI), Calcutta. Dr S.S. Ranganekar of Ranganekar Associates,

Bombay, conducted the course. The first day was devoted to 'Role of R&D Manager of a CSIR Laboratory in the present context of Globalisation'. About 40 members and senior R&D staff of the institute attended the lecture course. The lectures were highly illuminating. Virtually all the concepts put forward by Dr Ranganekar underwent refinement through a two way feedback between him and the audience. The second day covered 'Improving productivity of an R&D Manager of a CSIR Laboratory'. It included the concepts of team building, conflict management, work culture and human relations, etc, which are required to be developed for creating a congenial working atmosphere. Films on (i) Human resource development, (ii) Team building with boss and colleagues, and (iii) Work ethics and culture, were also shown. The relevant film scripts, which were distributed to the participants, helped them in understanding the underlying idea behind the lecture course.

At the end, a round table discussion was held with valuable observations made on some specific problems. The course was declared



The management expert Dr S.S. Ranganekar delivering a lecture on the management of a laboratory. Dr B.K. Sarkar, Director, CGCRI, is also in the audience



Shri Surya Kant Bali, Editor, *Navbharat Times*, giving the Science Quiz Competition Prize to a recipient. Also seen in the picture are Dr G.P. Phondke, Director, PID, and Smt Diksha Bisht, Editor, *Vigyan Pragati*

over with a vote of thanks by Dr B.K. Sarkar, Director, CGCRI, who pointed out the utility of joining such a management course for the participants. □

Vigyan Pragati's 2nd Annual Quiz Competition Prizes presented

THE Prize distribution function of the Second All India Science Quiz Competition organized by India's leading popular science monthly *Vigyan Pragati* took place on 26 September, 1995 at the lawns of Publications & Information Directorate (PID), New Delhi. The function was presided over by the Chief Editor, *Vigyan Pragati* and Director, PID, Dr G.P. Phondke. The Chief Guest of the function was Shri Surya Kant Bali, Editor, *Nav Bharat Times*. Speaking on this occasion, Shri Bali applauded the role of PID in popularizing science through its quality publications like *Vigyan Pragati* and *Science Reporter*. Dr

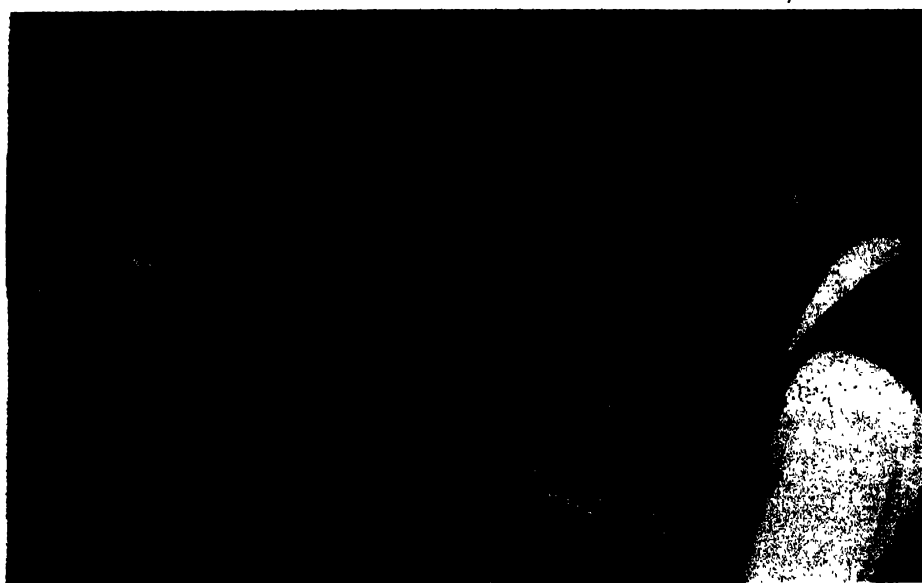
Phondke also addressed the gathering. While felicitating and encouraging the prize winners, Dr Phondke laid emphasis on the usage and importance of regional languages in popularizing science. The prizes were given away by Shri Bali and Dr Phondke.

Earlier, Dr R.A. Mashelkar, DG, CSIR, visited PID and met the prize-winners of the Science Quiz Competition. He was happy to know about the growing popularity of the magazine. While speaking to the prize-winners, Dr Mashelkar expressed his satisfaction over the science popularization work being done at PID and also congratulated the *Vigyan Pragati* staff and the prize-winners.

Vigyan Pragati had announced this Science Quiz Competition through its columns in the June '95 issue of the magazine. The response was tremendous. The selection of prize-winners was made on the basis of lots drawn by Prof S.K. Joshi, Ex-DG, CSIR, on 4 July 1995. □

NML Foundation Day Awards

ON the Foundation Day of National Metallurgical Laboratory, Jamshedpur, the Chief Guest Prof. T.R. Anantharaman gave away the NML Foundation Day Awards for the year 1994 to the following scientists/technologists at a function held in the laboratory.



Shri S.K. Das, Scientist, receiving the Nijhawan Award 1994 from the Chief Guest, Prof. T.R. Anantharaman



The Chief Guest, Prof. T.R. Anantharaman, handing in the Distinguished Service Award 1994 to Dr N.G. Goswami, Scientist

Nijhawan Award

Dr R. Kumar, Shri S.K. Das, Dr R.K. Ray and Dr A.K. Biswas were awarded Dr B.R. Nijhawan Award-1994 for their paper entitled "Leaching of pure and cobalt bearing goethites in sulphurous acid: kinetics and mechanisms" published in *Hydrometallurgy*, Vol. 32 (1993), pp. 39-59. Cobalt is often found associated with iron oxyhydroxide minerals, such as goethite, in sea nodules. The paper highlights the kinetics and mechanisms in sulphurous acid leaching of well characterized synthetic goethite samples containing cobalt in sorption and co-precipitation modes. Based on the results reported in the paper, it has been established that: (a) cobalt doped in sorption mode is leached faster as compared with co-precipitation mode; and (b) for the sample doped with cobalt in co-precipitation mode, cobalt and iron are leached congruently and leachability of cobalt is controlled by structure and leachability of the host goethite phase. So far the effect of mechanism(s) of incorporation of cobalt in iron oxyhy-

droxide minerals present in sea nodules and its leachability has been poorly understood. In this context the findings of the paper are significant.

Altekar Award

Dr A.N. Mukherjee, Shri T.L. Sharma and Dr P. Prabhakaram (Retd.) were awarded Prof. V.A. Altekar Award-1994 for the best technology developed - "Calorizing of steel". The process of diffusion coating of aluminium is known as calorizing. Calorized steel, a specially engineered iron aluminium surface alloy, offers good resistance to sulphurous atmosphere and high temperature oxidation. The calorized steels developed at NML were tested in PDIL, Sindri, at laboratory scale. The product also successfully underwent trial run at Sulphuric acid manufacturing plant of FACT, Cochin, and at the crude distillation unit of Indian Institute of Petroleum, Dehra Dun. NML's calorized steel, i.e., Aluminium Diffusion Treated Steel (ADTS), exhibited better performance in all the tests compared to commonly used carbon

steel. The corrosion losses due to the usage of plain carbon steel tubes in different heat exchanger tubes in sulphuric acid/SO₂/SO₃ environment, petroleum refineries, coal gasification and liquidification plants, ethylene pyrolysis sulphuric acid plants, furnace parts, annealing retorts, heat treating fixtures, lanching tubes, furnace curtains, etc., alone amount to few millions of rupees annually. The present demand in the country is met with import only. Alonized tubes are imported from ALONINMC, USA. NML's calorized steel (ADTS) has shown 100 % better performance when it is compared with the imported ones (ALCON). It has been estimated that for a plant with production capacity of 30,000 running meters of tubes of 50mm ID basis, the cost comes to Rs 6 million with return on investment 51 % and a breakeven point of 52 %.

Distinguished Service Award

Dr. N.G. Goswami, Scientist, was conferred with Distinguished Service Award-1994 for his outstanding contributions towards information dissemination and business promotion activities of the laboratory. □

Honours & Awards

P.K. Seth

DR P.K. Seth, Deputy Director and Head, Developmental Toxicology of Industrial Toxicology Research Centre, Lucknow, has been conferred the C.R. Krishnamurthi Lecture Award for 1995 by the Society of Biological Chemists (India) for his contributions in the field of biochemistry and allied sciences. The award carries a cash prize and a certificate. Dr Seth has been actively conducting basic and applied research over the

NCL signs MoU with a Singapore firm

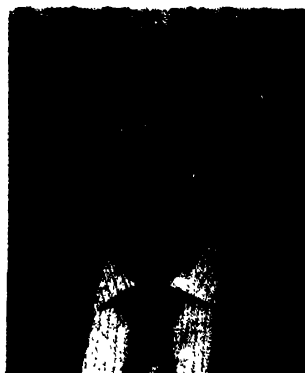
AN MoU was signed between the National Chemical Laboratory (NCL), Pune, and Hydrocarbon Projects Ltd., Singapore, on 14 September 1995 at Singapore for producing an organic chemical, 2 Methyl Glycohexol Acetate (2MCA), a solvent used in the manufacture of hydrogen peroxide which has considerable industrial applications worldwide. Shiv Dewan, Chairman of the Singapore company, and Paul Ratnasamy, Acting Director of NCL, signed the MoU. Also present during the ceremony were officials of the National Science and Technology Board of Singapore, which had hosted the event 'Technology Showcase '95' in Suntec City International Exhibition and Convention Centre.

The chemical catalyst process and basic engineering will be done by NCL, and the project will be funded by the Singapore company. "The collaboration will be a mutually beneficial one," said Paul Ratnasamy. "They are hoping to quadruple their production of hydrogen peroxide from the present 500-2000 tonnes, which will require greater quantities of the catalyst. This is where we can pitch in."

What is more important, the process developed by NCL is a chlorine-free one, which makes it more environment-friendly, an aspect that is attractive to the ecologically conscious Singapore company.

past 25 years in the field of biochemical pharmacology and toxicology and has played a major role in the growth of modern toxicology. His main interest in the basic research has been to delineate the role of neurotransmitter receptors in the action of the chemicals acting on the central nervous system. The neurotransmitter receptors studied included mainly serotonin (5HT₂), dopamine (D₂), GABA and acetylcholine (muscarinic).

Dr Seth has also demonstrated the characteristics of the serotonergic (5HT₁ & 5HT₂) and dopaminergic (D₁ & D₂) receptors in human blood platelets and evaluated their usefulness as a peripheral model for investigating the neurological disorders. His findings are of great clinical rele-



vance. He has also investigated the xenobiotic metabolizing enzyme in the mammalian brain and their role in action of neurotoxic agents. In recognition of his contributions he has been invited as Visiting Scientist and Visiting Professor in several prestigious institutions in USA and awarded Bodansky Lectureship, Fellowships of National Academy of Sciences (India), Indian Academy of Neurosciences and Society of Toxicology (India). He has served as Councillor for the Section of Toxicology and the Section of Drug Metabolism of International Union of Pharmacology (IUPHAR).

National Mineral Award for Dr Purnachandra Rao

DR V. Purnachandra Rao, Scientist, Geological Oceanography Division, National Oceanographic Institute (NIO), Goa, has been selected for the National Mineral Award for the year 1994 by the Ministry of Mines, Gov-



ernment of India, in applied geology for his significant contributions in marine geology, particularly for his investigations on minerals occurring along the east and west coasts of India.

Dr Rao obtained his M.Sc. (Marine geology) from the Andhra University, Waltair, in 1980. He joined NIO in the same year and worked on transport pathways of fine-grained sediments on the continental margins. His research work on phosphorites, verdine and glaucony facies is important in understanding the genesis and paleogeography of the continental margins during the Quaternary period. He was a visiting scientist to Florida State University, USA, in the year 1987. He visited University of Rouen, France, as a post-doctoral Fellow from November 1991 to October 1992. He has published over 30 research papers. He was awarded UNESCO/ROSTCA Young Scientist Award in 1989 and CSIR Young Scientist Award in 1990. Presently, he is working on paleoclimates.

Printed and Published by Dr G.P. Phondke, Director, Publications & Information Directorate (PID), Dr K.S. Krishnan Marg, New Delhi - 110 012
Printed at PID Printing Unit

Editors : Dr B.C. Kashyap, Dilip M. Salvi and Madhu Sahni
Phone: 5786301 Gram: PUBLIFORM

Production : Kaushal Kishore

Telex: 031-77271

E-mail: pid@ sirnetd.ernet.in.

Fax: 5787062

RN 4312/57

CSIR

NEWS


VOL 45 NO 21 15 NOVEMBER 1995

LCA Composite Fin and Rudder Handed Over to HAL

NATIONAL Aerospace Laboratories (NAL), Bangalore, formally handed over the co-cured composite fin and rudder of the Light Combat Aircraft (LCA) to Aeronautical Development Agency (ADA) recently. Dr R.A. Mashelkar, Director-General, CSIR, handed over the fin and rudder to Dr Kota Harinarayana, Programme Director, ADA, at a ceremony in Bangalore. As the LCA is to be eventually fabricated and assembled by Hindustan Aero-

nautics Limited (HAL), Dr Harinarayana, in turn, handed over the wing to Shri R.N. Sharma, Chairman, HAL, who most graciously agreed to preside over the function.

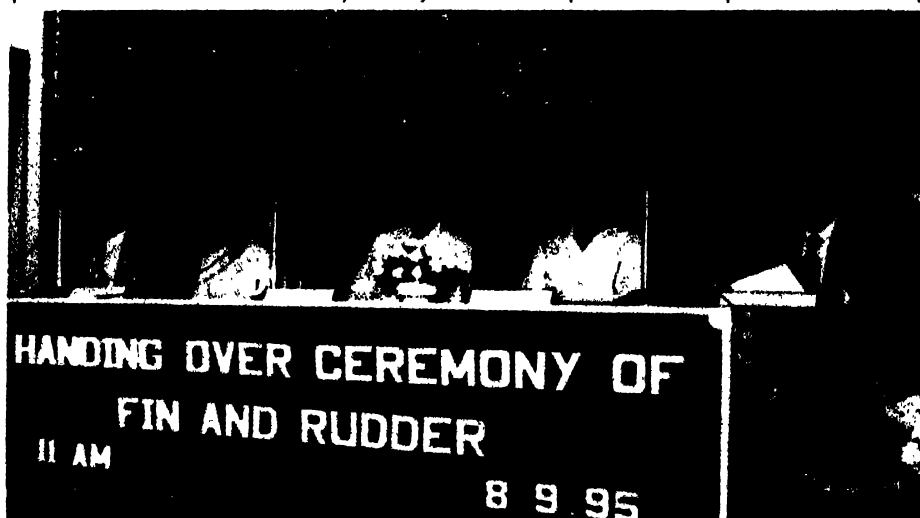
The LCA fin, which was both designed and fabricated by NAL, has been largely designed using the co-curing fabrication technology. A special advantage of this technology is that it allows effective part consolidation, thereby leading to a configuration with a minimum number of parts. In fact, the fin has only 7 major

parts; 5 composite parts and 2 metallic root fittings. Of the five composite parts, four parts are designed as integral assemblies and have been produced through co-curing.

Several fabrication techniques were employed to produce the composite parts of the fin. These include inflatable rubber mandrill method, dissolvable core technique, thermal expansion route using silicon rubber cores and also cores cast using aluminium powder in epoxy resin. All these parts were produced using

IN THIS ISSUE

New ITRC Findings	322
Wood Substitute Technology transferred	324
Regional Research Laboratory, Bhubaneswar R & D Highlights: 1994-95	327
Modern Biology and Biomedical Applications	332
Obituary: S. Panichapakesan	334



Handing over ceremony of Light Combat Aircraft's composite fin and rudder held at NAL, Bangalore

composite moulds developed in-house at NAL. Powerful finite element softwares like ELFINI, MSC-NASTRAN and NAL's own FEPACS were employed to optimize the fin structure. The design exercise carried out meets the complex requirements of static strength, buckling, fatigue and aeroelasticity.

The LCA rudder, fabricated by NAL and designed by HAL (ADB), has an interesting hybrid construction. The NAL fabrication route for producing this includes the use of composite tools.

The rudder comprises an integral ribskin construction for the inter spar box (ISB) and has a sandwich aft box. The ISB was produced as a single jointless co-cured unit using composite tooling with inflatable mandrills. Specially designed composite moulds were also used for skin-core bonding of the sandwich aft box.

Both the LCA fin and rudder were developed according to specially formulated quality procedures. Non-destructive evaluation (NDE) was performed using ultrasonic A and C-scan equipment. A new method was developed to carry out NDE of the co-cured components using the transmission squirter type ultrasonic C-scan system.

The fin and rudder were assembled on jigs and fixtures developed in-house. A notable feature of these programmes was the periodic review of all development aspects by specially-constituted expert committees. The development programmes benefited enormously because of the unstinted support and guidance they received from ADA, HAL, CRE, CRI and DRDL.

One of the most heartening features of the LCA fin and rudder development exercise was that it was truly a multi-institutional affair with every national agency offering excellent support for the programme. Dr Harinarayana acknowledged this support when he remarked that the LCA teams must be more appropriately re-christened "Team India".

The function, which was attended by all Directors of CSIR laboratories and institutes, opened with a welcome address by Dr K.N. Raju, Director, NAL. Dr Raju said that it was a "memorable day for NAL marking the culmination of intense efforts over the past five years". He also read out messages from Shri Bhuvnesh Chaturvedi, Minister of State for Science and Technology, and Dr A.P.J. Abdul Kalam, Scientific Adviser to Raksha Mantri complimenting NAL on attaining a major

technological milestone. Dr B.R. Somashekar, Head, Structures Division, described the salient features of the NAL fin and rudder technologies and explained how a mere technology development project blossomed into a full-fledged LCA component development programme.

Dr R.A. Mashelkar, Director-General, CSIR, said that the handing over of the LCA fin and rudder was a proud moment for everyone at CSIR. He also used the occasion to articulate his new slogan for CSIR 2000 and CSIR 2010: "Let us reach our potential".

Shri R.N. Sharma, Chairman, NAL, congratulated NAL on behalf of the Indian aeronautical community for its wonderful achievement. The HAL Chairman also pointed out the strong compulsions which are driving technology development programmes such as LCA and ALH. "We should view these exercises in the context of generation of national wealth", he said. Shri Sharma also used the opportunity to sound a note of caution. "It is not enough to have first rate individual aircraft components. The real test is to put them together without sacrificing quality. The orchestra, and not individual performers, must play the best tune", the HAL Chairman remarked. □

R & D Flashes

New ITRC Findings

Neurodevelopmental toxicity studies on synthetic pyrethroid insecticides

Synthetic pyrethroids, a new generation insecticides of high bioefficacy and low mammalian toxicity, are cur-

rently being used in India for agricultural pest management and public health programmes. In view of the possibility of a large number of pregnant women and growing children being exposed to these chemicals at the work place or through the gen-

eral environment, studies were conducted at Industrial Toxicology Research Centre (ITRC), Lucknow, on functional neuroteratological risk assessment of three synthetic pyrethroids, viz, fenvalerate, cypermethrin and deltamethrin in

developing rats. Data generated following pre-and post-natal exposure indicate that immature mammals are more susceptible to pyrethroid poisoning and that both the dopaminergic and cholinergic neurotransmitter receptor systems are involved in its neurotoxicity. The effects were more pronounced during the "growth spurt" period indicating a functional delay in brain maturation. The modulation in the activity of the enzymes of neurotransmission processes, i.e., monoamine oxidase, acetyl-cholinesterase and Na^+K^+ -ATPase, alterations in polyamines, viz, putrescine, spermidine and spermine levels in brain regions and various neuro-behavioural alterations revealed further that immature brain is more susceptible to pyrethroid poisoning. Among the three pyrethroids studied, deltamethrin was found to be highly neurotoxic at much lower dose.

The preliminary evaluation of pesticide residues in placenta, maternal blood, cord blood and in the blood of male sprayers showed traces of cypermethrin, fenvalerate and deltamethrin. These observations raise concern for health risks to the general population including pregnant women, growing children and humans working at the manufacturing site and in agricultural fields.

Effect of noise pollution on employees of a paper mill

Noise pollution is a serious problem in many industries. Noise monitoring and studies on its effect on the auditory and other organ systems in exposed subjects were carried out in a paper mill. Mean noise levels in different sections ranged from 80.0 to 99.0 dB while it was above 60.0 dB in office, canteen, etc. 29.2 per cent of the subjects were found to have

abnormal audiograms. Significantly high prevalence of noise induced hearing loss was observed in workers from rag, rag boiler and digester house (36.4%) as compared to the control subjects (8.9%).

Subjects exposed to 80 to 96 dB of noise were also assessed for alteration in clinical status. Neurobehavioural functions were examined with the help of a modified version of standard questionnaire. The functions assessed were fatigue, insomnia, decreased concentration, depression, irritability and gastric, sensory and motor symptoms. The study did not reveal alterations in cardiovascular or neurobehavioural functions except for insomnia, which was found to be more in subjects with longer duration of work history.

The results of this study conducted at ITRC contradict the view that stimulation of auditory system within the noise range of 80 to 96 dB spills over into part of non-auditory nervous system. Also, it has not been found that neural impulses from sensory receptor such as the ear can stimulate the non-auditory neural parts of the brain.

Studies on cellular mechanism of benzene toxicity

Release of iron from ferritin by polyphenolic metabolite of benzene 1,2,4-benzenetriol (BT) was studied. Presence of BT resulted in the release of significant amount of iron from ferritin and the increase was concentration dependent of BT. The iron released from BT enhanced lipid peroxidation and also catalyzed the release of aldehydic products from bleomycin dependent degradation of DNA. Addition of BT to bone marrow cell lysate resulted in an increase of iron release as a function of time.

ITRC studies indicate that BT is a potent reductant of ferric iron of ferritin and also mobilizes and releases iron from ferritin core. The release of iron from bone marrow lysate by BT may be of toxicological significance as this could lead to disruption of intracellular iron homeostasis in bone marrow cells. It was also observed that iron polyphenol chelate (FE:BT) markedly enhanced bleomycin-dependent DNA degradation in comparison to iron alone. It is concluded from the present study that the phenolic metabolites of benzene enhance the availability of Fe(II) by releasing the iron from ferritin and forming a chelate, thus protecting the Fe(II) from hydrolysis to hydroxides. This ITRC study offers a new mechanism that the iron released from ferritin by BT could contribute to the better understanding of the toxicity of benzene. In the light of the present results, it is believed that the BT-induced iron release in bone marrow cells *in vivo* leads to generation of superoxide radicals, peroxidation of lipids and probably alters maturation and differentiation of bone marrow cells resulting in bone marrow depression which is expressed in humans as well as experimental animals during benzene exposure. Presence of polyphenol iron chelates *in vivo* after benzene exposure is not known. Further studies are in progress to characterize such complexes *in vivo* and evaluate their toxicological significance in benzene-induced hematotoxicity.

An outbreak of tricresyl phosphate poisoning in Calcutta: An 18 month follow-up study

Tricresyl phosphate (TCP) is an odourless, colourless and stable industrial chemical. It is used in lacquers and varnishes, in cellulose



Wood Substitute Technology transferred

REGIONAL Research Laboratory (RRL), Bhopal, Building Materials & Technology Promotion Council and M/s Dual & Visual Group Companies, Madras, have entered into an agreement for manufacture of R-Wood products on 10 October 1995. R-Wood is a 100% wood substitute product developed at the laboratory. It is based on the use of industrial wastes such as red mud from aluminium industries and flyash from thermal power plants.

M/s Dual & Visual Group Companies have considerable experience in the manufacture of low cost alternate building materials. They specialise in flyash-based products like brick and blocks. With a turnover of Rs. 500 million and many prestigious projects, including container terminals for ship yards, steel re-rolling mills and several high-rise buildings in and around Madras, they have now selected wood substitutes technology of RRL for commercialization.

CPWD banned the use of wood in its works from April '93 and subsequently accepted the use of R-wood products for door shutter applications. RRL developed this technology as a part of CSIR-CPWD networked programme. Building Materials & Technology Promotion Council of the Ministry of Urban Development has supported this project. Dr T.N. Gupta, Executive Director of the Council, is guiding development, marketing and commercialization efforts. Prof. T.C. Rao, Director, RRL, Shri A. Anjaiah, Director of the company, senior scientists and officials of RRL were present on the occasion of signing the agreement. □

acetate, nitrocellulose and polyvinyl-chloride sheets as a plasticizer and also in hydraulic fluid, which is used in ships and nuclear powered submarines. TCP has been shown to cause polyneuritis in animals and humans, eventually leading to paralysis of the hands and feet. Outbreaks of TCP poisoning have occurred in the past in USA, Morocco, India, Durban and Sri Lanka. During the past decade, two major epidemics occurred in West Bengal. However, no scientific report regarding these outbreaks is available.

In 1988 an outbreak caused by the consumption of adulterated rapeseed oil occurred in the Behala area on the south-west outskirts of Calcutta. Though there were no deaths, about 600 victims reported to Vidya Sagar Hospital, Calcutta, of which 343 were admitted. Of these patients, 203 were males and 140 females. Out of 40 oil samples collected in 1988 six samples showed the presence of TCP to the tune of 22-57% while none of the samples collected during December 1989 showed the contamination of TCP.

Among the 296 subjects studied, 166 (56.1%) were males and rest were females; 36.1 per cent were 18 yrs or less of age, of these 21.9 per cent were 12 yrs or less.

Complete recovery was observed in only 37.9 per cent of the subject. The rest of the subjects had partial (47.9%) slight/no recovery (14.2%).

Acute symptoms were experienced by majority of subjects on the same day. CNS symptoms were observed by 62.6 per cent of the subjects before seven days. The majority of the victims had consumed contaminated oil for a period of 1-3 day while three subjects in 'no recovery' group had used it for more than a week. The TCP intake has been calculated to be in the range of 20-25 gm per person.

Acute symptoms were reported by all subjects. Bitter taste was experienced by approximately 80 per cent of subjects in all the recovery groups. Other common symptoms were pain in abdomen, diarrhoea and vomiting. Symptoms pertaining to CNS included weakness in legs, arms, poor handgrip and paralysis of upper and lower limbs, were reported by all the subjects in no/slight recovery and partial recovery groups. In the complete recovery group weakness in arms and legs was reported by almost all the subjects (94.6%) whereas paralysis was reported by roughly 65 per cent of subjects.

The results of this ITRC study show that human subjects who have ingested 20-25 g of TCP suffered from polyneuropathies which may vary from weakness in small muscles of hand and foot to paralysis of limbs involving large muscles. The recovery from these effects may be influenced by factors of age, nutritional status and use of alcohol and/or other addictions. □

New NIO Findings

Ancient Seamounts

RECENT studies at National Institute of Oceanography, (NIO), Goa, on the distribution and morphology of ancient (50 Ma) seamount chains in the Central

Indian Ocean Basin (CIOB) suggest their near-axis origin. Petrochemical studies on fresh glass veneer of pillow basalts from these seamounts show low content of TiO_2 FeO, and moderate Mg, suggesting low rate of erup-

tion of voluminous and less fractionated near-positive magma at or near the southeast Indian ridge axis.

In terms of petrology, chemistry and morphology, these seamounts occurring on the fast generated ancient CIOB crust are comparable to those occurring in chains on fast spreading young Pacific Ocean and in random on slow accreting young Atlantic Ocean crusts. This study also proves that distribution and disposition of near-axis seamounts varies as function of spreading rate, whereas other characters are independent of crustal accretion rate.

Evidence for deeper carbonate compensation depth

THE geochemical study of calcareous sediments and CaCO_3 depth relationship from the SW Carlsberg Ridge by NIO scientists has revealed the occurrence of deeper lysocline (4700 m) and deeper carbonate compensation depth in this region. Inverse relationship between benthic ratio and CaCO_3 also supports high biological productivity whereas increase in the benthic ratio points towards increase in the degree of dissolution with depth.

Mn crust from the Afanasiy-Nikitin seamount

FE-Mn crust from the Afanasiy-Nikitin seamount (water depth about 1650 m) has cobalt concentration upto 0.8%. The crust has accreted on a carbonate cement substrate which was once exposed over the sea surface. The maximum age estimated for the crust is around 10 my B.P. This is the first report of cobalt-rich crust from the CIB seamounts. Study in detail is under progress at NIO, Goa.

Authigenic green clays

VERDINE (phyllite V, Phyllite C) and glaucony (Glauconitic smectite, glauconitic mica) are two authigenic marine green clay facies, occurring in shallow marine environment and the study of their distribution can be used to construct the paleogeography of the margins.

Eighty two sediment samples occurring on the eastern continental margin of India between Godavari and Mahanadi, ranging from 18 to 247 m depth were studied at NIO, Goa. The inner shelf (18-70 m) grains are dark green and irregular, while the grains on the outer shelf (71-125 m) occur as dark green pellets. The green grains at depths deeper than 170 m are mostly dark-green with internal moulds of planktonic and benthic foraminiferas. These grains at depths between 18 and 125 m consist of poorly crystalline phyllite V. At 170 m oodinite occurs and further seaward between 200 and 247 m glauconitic smectite is present. It is suggested that verdine and glaucony facies from the continental slope sediments may correspond to Last Glacial Maxima and the outer shelf facies formed during subsequent transgression. The inner shelf green grains may represent the present day formation of verdine facies.

The distribution of verdine and glaucony in this margin is similar to that of green grains distribution in the Senegalese continental margin and in the French Guiana margin but significantly differs from that of west coast of India. On the Kerala continental margin, verdine occurs down to 280 m water depth in contrast to 170 m water depth on the eastern margin. These differences may suggest that the paleogeography of the western margin is different from that of east coast of India.

Relationship of river discharge and size of benthic foraminifera variations in the Mean Proloculus Size (MPS) of the benthic foraminiferal species *Rotatidium annectens* were studied in a core collected off Karwar (20 m water depth), west coast of India. Comparison of downcore variations in the MPS with rainfall (five years average) over a period of 100 years from the catchment area of the Kali river shows a direct correlation. This implies that higher MIPS values indicate high rainfall over the catchment area and thus confirms that the MPS is inversely related to salinity. The correspondence between MPS and rainfall shows a high potential in generating proximity data for the reconstruction of a paleo-precipitaitonal history.

Magnetic anomalies and granulite belts

MAGNETIC data of the eastern continental margin of India helps in demarcating the offshore extension of the granulite belts and their possible link with those of east Antarctica. Magnetic data along the three parallel coastal profiles over the innershelf (30-50 m water depth) off Mahabalipuram recorded short wavelength and high amplitude (200-700-nT) anomalies. Two NE-SW trends are delineated, one off Palar river and the other south of Mahabalipuram. Folded and faulted magnetic basement is recorded beneath the Mahabalipuram shelf while the Palar river was found to be associated with a faulted basement by NIO scientists.

Sedimentological studies of Kakinada Bay

ACCORDING to NIO studies, the sediments of Kakinada Bay are predominantly silty-clayey with a phi



mean range between 2.92 and 7.8. The northern, central and southern parts of the Bay consist of finer sediments (5.5 - 7.7) while the eastern and western parts consist of sandy sediments (2.9 to 3.05). Inter-relationship of size, statistical parameters and the CM diagram of the Bay sediments suggests a mechanism of slow deposition from quiet water. Montmorillonite is the predominant clay mineral followed by Kaolinite and illite reflecting the geology of the source area.

Inter - annual variability of SST in Bay of Bengal

MEAN SST charts over Bay of Bengal for the month of February 1982 and 1988 have been prepared at NIO, Goa. Satellite derived SST for the years 1992 and 93 also have been analyzed. A large scale flow associated with western boundary current (WBC) was noticed during *El-Nino* and deficit monsoon years. In 1992 (March first week), WBC was identified from satellite SST data. No such large scale feature was noticed during normal and excess monsoon years. It appears that the presence of WBC during late winter may lead to a weak monsoon activity. Further studies are required to confirm these results.

Fluctuation of salinity maximum in the western Bay of Bengal

THE spatial distribution of the salinity maximum is studied in the western Bay of Bengal by NIO scientists. Mesoscale processes developed in the area may contribute to the fertilization of the region. North Indian Equatorial Water enter the region through the surface layer. A frontal zone centred between 16°N and 18°N separates the Bay of Bengal

and the Red Sea Persian Gulf intermediate water at the surface layer. Anti-cyclonic eddies with a radii of 50 km occur off the central and southern east coast of India. Anti-cyclonic gyres might contribute to the upwelling off Visakhapatnam and to the occurrence of local sinking in its centre about 50 km offshore, thus allowing long residence time and recirculation. A cyclonic eddy of approximately 100 km diameter was observed to separate from a frontal feature near 16°N, 83°30'E. Although not obviously associated with the Red Sea Persian Gulf intermediate water core, the eddy did penetrate to a depth of at least 600 m. The major results concern the advection of the Red Sea Persian Gulf Intermediate Water (RSPGIW) along its northward route; spreading of the RSPGIW and its trapping by the eddy fields; the interaction between the south Bay of Bengal and northwestern Bay of Bengal. The salinity maximum core is found to be quite persistent in its value and geographic distribution.

Two discontinuities in Bay of Bengal

NITRIC oxide (NO) together with potential temperature has been used as a tool to study the discontinuities in the water column of the Bay of Bengal by NIO scientists. Oxygen-salinity (O-Sal.) plots were drawn using the data collected during different cruises in the Bay of Bengal. O-NO plots revealed two discontinuity layers - one at 25°C and the other at 10°C, probably because of the two mixing water masses. Physico-chemical characteristics of the two discontinuities were evaluated.

Variation in the water quality with tide at Visakhapatnam harbour, Kakinada Bay and Gouthami-Godavari estuary

PHYSICO-chemical parameters in relation to tide at Visakhapatnam harbour, Kakinada Bay and Gouthami-Godavari estuary have been studied and compared by NIO scientists. Higher nutrient concentrations except for ammonia-nitrogen were recorded at Visakhapatnam harbour during pre-monsoon. In general, nutrient concentration in the area of study were high during ebb tide. Variations in chemical constituents were mainly due to the discharge of industrial effluents and domestic sewage at Visakhapatnam harbour, while at Kakinada Bay and Gouthami-Godavari estuary these were due to agricultural run-off and domestic sewage.

Ocean trophic dynamics

THE soldier crabs *Dotilla myctiroides* are found in the sandy intertidal region of Goa with an average population density of 92/m². The sediment reworking rate is estimated to be 4.5 kg/m²/day.

Experimental studies carried out at the NIO laboratory using soldier crab to evaluate the role of bioturbation in recycling of nutrients indicated an enhanced nutrient flux.

The nitrite and nitrate values increased from 0.44 to 0.7 and 2.65 to 3.75 µmol/l respectively. □

Regional Research Laboratory, Bhubaneswar

R & D Highlights: 1994-95

The Regional Research Laboratory (RRL), Bhubaneswar, conducts research and development activities in the areas of mineral processing, extractive metallurgy, inorganic chemicals; drugs, perfumeries and pharmaceuticals from forest and marine resources; and cultivation of aromatic, medicinal and spice plants and extraction of essential oils from them. Physical and chemical analysis of raw materials and other industrial products also constitute an important activity of the laboratory.

The laboratory is paying increasing attention to interaction with industry, socio-economic ministries and other potential users so as to make its R & D output more and more industry/user-oriented. During 1994-95, it undertook 2 sponsored, 20 consultancy, 4 grant-in-aid and 2 collaborative projects. Three sponsored, 2 collaborative, 12 consultancy, 3 grant-in-aid and 4 in-house projects, some of which continuing from the previous years, were completed. The earnings from sponsored/consultancy/grant-in-aid projects and testing jobs amounted to Rs 17.12 million.

The major R & D activities/accomplishments of the laboratory in the various areas, during 1994-95, were as follows.

Design and Project Engineering

Under the Orissa Environmental Programme, bench and pilot plant scale studies for hydraulic transportation of fly ash were carried out which also covered techno-economics of setting up a commercial scale slurry pipeline of

100 to 150 tonnes per day capacity. Reliability of refractory bricks was evaluated for M/s Boppedie Refractories Pvt. Ltd. Under the NPIC programme for further improvement of *chulhas*, several new models of multi-fuel *chulhas* were developed and released through Orissa Renewable Development Agency and Ministry of Non-conventional Energy Sources, Government of India. This programme has attracted nation-wide attention and several parties from other states like Kerala, Arunachal Pradesh, West Bengal, etc., have shown keen interest in popularizing these models in their respective states. Besides these funded projects, some in-house projects like development of foundry chemicals, leaching of ores and minerals using ultrasonics, pneumatic transportation of fly ash, automatic control system for SX system, and development of energy sav-

ing devices and agricultural implements for rural sector were also pursued.

Forest & Marine Products

Two expeditions were made for collection of marine organisms under the DOD project 'Bioactive substances from sponges of Orissa coast'. More than 35 extracts from 22 organisms and fractions from earlier identified six extracts were sent for biological screening. Anti-fouling studies of some of these extracts have shown encouraging results. Fifty pure cultures of microorganism associates were isolated. Pilot plant studies on the preparation of metal ion extractant 2-hydroxy-5-nonyl-benzophenone oxime were carried out in collaboration with CSFC. The processes developed for extraction of gal-



Solvent extraction pilot plant – stage mixer settler unit



Flotation column for beneficiation of coal fines established by RRL - Bhubaneswar at West Bokaro

lic acid from Myrobalan and its conversion to TMBA were demonstrated to a party through NRDC. Extracts of *Moringa oleifera* were found to possess neunaticidal properties against root knot *nematodes*. Two projects, viz. 'Integrated utilization of saponin-bearing plants' and 'A systematic approach for improved *kewda* industry', were taken up. Studies on honey collected from *S. emerginatus* germination of sapindus species have been undertaken. A survey on the availability of *kewda* plants and distillation of *kewda* oil has been initiated and efforts are being made to improve the oil yield through modified distillation stills. Under the project sponsored by Forest Department, Government of Orissa, on 'Search for alternative uses of *kendu* leaves' two new triterpenes have been isolated.

Hydro & Electrometallurgy

The laboratory has been actively engaged for the past several years in R & D on processing of poly-metallic nodules to extract metal values; a process developed for this purpose is being pilot tested. Another major project in the area, i.e. extraction of nickel from the lateritic nickel ore has been completed, and decision by the Government of India for future work is awaited. Besides these major projects, other projects pursued relate to



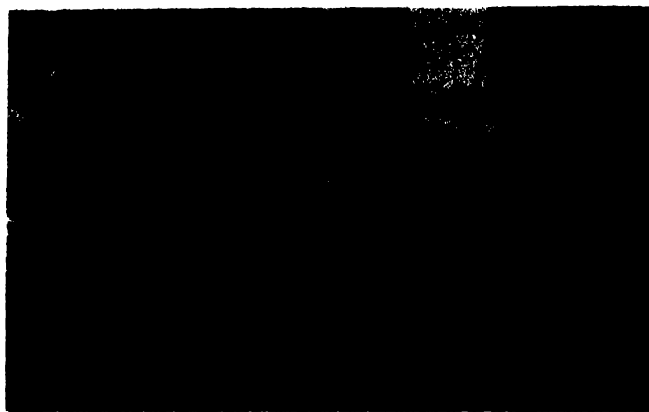
Slurry transportation pilot plant at RRL - Bhubaneswar

: (i) recovery of copper and zinc from secondaries and complex materials, (ii) bio-recovery of metals from effluents; (iii) preparation of highly pure iron oxide through aqueous route for soft ferrite application; (iv) bio-leaching of manganese ore; and (v) leaching of phosphorus from fluorspar. A project on developing a process and design-

ing a plant for extraction of cobalt from sludge has been initiated. Presently, efforts are being encouraged in India to treat effluents, complex materials, and secondaries. This is reflected in the financial support received for carrying out all the above projects. In addition, several in-house projects were also pursued: (i) ways and means for energy reduction in electrowinning, (ii) environmental aspects of metallurgical and mining industries of Orissa, (iii) electroleaching of sulphides, and (iv) hydrometallurgical processing of secondaries. At the international front, the association of the Hydro & Electrometallurgy Division with German Agency for Technical Cooperation (GTZ) continued. A joint programme to examine the role of additives on zinc electrowinning with Murdoch University, Perth, Australia, has also been taken up.

Inorganic Chemicals

Twelve projects were pursued in this area, of which eight were externally funded. In recognition of the work done on the evalu-



Plant for sintering of manganese ore fines commissioned with the technology developed by RRL- Bhubaneswar at Sandur Manganese Mines.

ation of hexavalent chromium in chromite mine waters, Orissa Environment Programme (Indo-Norwegian Cooperation) has assigned a one-year project on 'Preparation of feasibility report for abatement of pollution caused by chromite mining and processing industries in Orissa'. Work on methane flux was extended to Chilka lake, the largest brackish water lake in the country. Interesting observations have been made on the calcination characteristics of red mud and also its utilization as a soil conditioner. Two environment-related programmes on alum sludge and selenium emission from thermal power plants were initiated. Work on the catalytic characteristics of manganese nodules is progressing satisfactorily and an important observation was made on the catalyst activity in nitrogen oxide control. High purity graphite was produced by alkali-acid treatment as a part of an externally funded project.

Mineral Beneficiation

The scenario of mineral production in the country will undergo significant changes with the new policy of liberalization, reduction of customs duty and lifting of control on imports. The task ahead for the mineral engineers has become more challenging than

ever before. The industry is now required to process increasingly complex, lean ores and to recover metal values from fines and rejects. The role of the Mineral Beneficiation Division of the laboratory has been therefore re-oriented with a view to solving R & D problems related to energy and environmental aspects for different minerals and for additional resource development from wastes. Work was continued to achieve the primary objectives, viz. (i) Evaluation of low-grade ores and minerals to develop suitable flow sheets for the industry; (ii) Development of innovative and new techniques for utilization of complex ores; and (iii) Basic and fundamental research to support the above activities.

The following consultancy/sponsored projects were completed: (1) Design and operation of demonstration flotation column for fine coal recovery at West Bokaro (M/s Tata Iron & Steel Co., Jamshedpur); (2) Beneficiation of sillimanite using flotation column (M/s Indian Rare Earths Ltd, Bombay); (3) Coal beneficiation for slurry combustion (CSIR Mission Programme on Clean Coal); and (4) Recovery of charge chrome values from granulated slag (Indian Metals and Ferro Alloys, Bhubaneswar). In addition, preliminary studies on 'Improvement in the flotability of oxidized high-ash Indian coals by ultrasound', 'Selection of flotation collector - a novel approach', 'Performance of demulsifier prediction based on film pressure and solvent properties' and 'Extraction of P205 from Indian slags of iron and steel industry' have been carried out for industrial applications.

Mineralogy and Metallography

Characterization of minerals, ores, sinters, slags, tailings, leaching resi-

dues and other industrial waste products is considered as one of the requisites for their further processing in terms of upgradation or obtaining metal values from them. Studies on several low-grade ores like graphites from Balangir district, Manganese ores from Nishikhal, fly ash from Talcher and red mud from NALCO, etc., have been undertaken. In all these projects, abundance and distribution of mineral phases, gangue association, textural peculiarities, liberation sizes, amenability for further processing, etc., were looked into. Detailed studies were taken up on high-Fe sinters provided by SAIL, Ranchi. Detailed macro- and micro-level characteristics of various ferrites and silicate phases, their quantification and micro-structural peculiarities in different sinter samples were interpreted in terms of their quality and reducibility. The laboratory also contributed significantly to the evaluation of kimberlitic indicator minerals in search for hidden diamond-bearing kimberlite pipes. In the marine pollution studies programme, the water quality, heavy metals in sediments, biological and microbiological parameters were constantly monitored from several stations : Digha, Dhamra, Paradip, Puri, Rusikulya and Kalingapatnam. The concentration of heavy metals and pesticides in fishes was found to be within the permissible limits.

Pyrometallurgy

In the area of pyrometallurgy, direct reduction of iron ore fines by fluid bed technique, utilization of wastes like fly ash and red mud in cement and aggregates and sintering of iron ore fines have been the major R&D programmes.

Work was continued on externally funded projects such as (i) Upgradation of low-grade bauxite for refractory and ceramic applications (Department of Science and Technology, Government of India); (ii) Development of a process for preparation of DRI fines using fluid bed technique; Calcination of magnesite; Conversion of kimberlite tailings to cementitious aggregates (all the three for National Mineral Development Corporation Ltd, Hyderabad); (iii) Setting up of a 35 TPD capacity pan sintering plant at the Sandur Manganese & Iron Ores Ltd, (Metal & Ferro Alloys Plant, Vysanakere, Hospet, Karnataka); (iv) Sintering of Daitari iron ore fines (Mideast Integrated Steels Ltd, New Delhi); and (v) Studies on manufacture of light weight aggregate alumina and cement clinker for bulk utilization of Talcher fly ash (Department of Environment, Government of Orissa). A new externally funded project relates to 'Reduction roasting of oxidic nickel ores in fluidized bed'. Awarded by the Board of Research in Nuclear Sciences, Department of Atomic Energy, Bombay, this project is of three years' duration. A major laboratory project with two sub-titles: (i) Roasting of brass ash for removal of chlorine followed by leaching to extract copper and zinc, and (ii) Enrichment of low-grade ferruginous high phosphorus manga-



Cultivation of palmarosa, citronella and lemongrass

nese ore employing reduction roasting followed by magnetic separation technique has been also initiated. As coal-based iron-making processes are likely to be adopted in the coming years, a basic research project on smelt reduction for better understanding of reaction mechanisms and influence of sulphur and phosphorus on reduction kinetics has been initiated.

Special Materials

Laboratory scale investigations on plasma processing for smelting of ore fines, melting and refining of metals, dissociation of minerals and synthesis of industrially important materials have been successfully completed. Besides, expertise for augmenting plasma facilities indigenously has been developed. At present investigations on four major projects funded by BRNS-Bombay, DST- New Delhi and RDCIS-Ranchi are in progress. As per the scheduled programme of BRNS funded project, the plasma dissociation unit has now been scaled up to 10 kg/h capacity. In collaboration with engineers of RDCIS, Ranchi, RRL scientists are carrying out kinetic studies on manganese ore reduction in a

plasma reactor to prepare Fe-Mn. Two major DST-funded projects, namely, (a) Thermal plasma synthesis of industrially important carbides (SiC, TiC and WC) and (b) Thermal plasma dissociation of molybdenite are now being treated as major programmes. Studies are in progress to prepare fused tungsten carbide grains for wear resistant cutting tools and plasma spraying applications. Studies on large scale preparation of SiC from rice husk in the plasma reactor are being also made. Laboratory scale investigations on the preparation of nanomaterials and surface modification by nitriding are also in progress.

Aromatic and Medicinal Plants

Agronomical, plant improvement and tissue culture studies on palmarosa, lemongrass, citronella, jamrosa, *Ocimum* spp., vetiver, anbrette, patchuli, *kewda*, simarouba glauca, rubber and some fast-growing tree species were continued. Under a new project on wasteland utilization, five suitable plantation sites in wastelands have been identified after survey. Planting material of suitable species for trial are being raised/procured by undertaking plantations in the next season. Under the Central Sector Scheme of Government of India for the development of aromatic and medicinal plants, improved varieties of palmarosa, lemongrass, citronella and cinnamon have been grown in 2.15 ha during the year, besides maintaining the previous year's crop in 1.85 ha for production and supply of

quality seeds/ planting material in Bhubaneswar.

A major accomplishment in this area was the publication of the first volume of *Flora of Orissa*; the second volume is in press and writing work for the third and fourth volumes is being carried out.

Physico-chemical Analyses of Raw Materials/Industrial Products

More than 7200 samples were analyzed at an estimated cost of Rs 2.42 million. Direct cash flow amounted to Rs 0.15 million. The scientists of the CPAF division were involved in about 40 R&D projects. Work has been carried out under projects related to large-scale preparation of copper phthalocyanin, Indian Reference Materials, fabrication of 5 kg/batch P.H. iron oxide, pollution in and around iron ore mines of Orissa, evaluation of products from some commissioned chemical plants and inorganic phosphors. A few X-ray diffraction standards were prepared. A survey of X-ray machines in Orissa was made under a project funded by Atomic Energy Regulatory Board. Extraction of chromium into organic solvents to selectively isolate it from complex matrices was also carried out. Basic research on the modelling of transport of metal complexes through supported liquid membrane, thermal decomposition of hydrated metal chlorides, and reduction leaching of manganese oxides in dilute acids is being actively pursued.

One hundred twenty six papers were published in reputed journals/conference proceedings; 115 technical papers were presented in 44 national and international seminars/symposia/workshops, and eight patents were sent to the CSIR Patents Unit for filing during the year. □



Artisans forging bell metal ingots using the traditional hand tools and raw coal for making utensils during a workshop cum demonstration programme on 'Bell metal production using raw coal' conducted recently by RRL - Bhubaneswar, NISTADS, HCL and OCMC

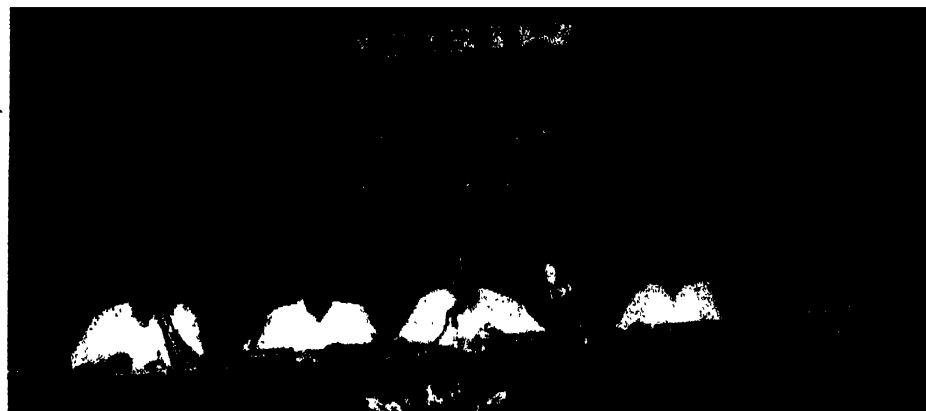
Foundation Day Celebrations

R & D is Key to Development

DELIVERING the CSIR Foundation Day Lecture on 26 September 1995 at Central Mining Research Institute, (CMRI), Dhanbad, Shri S.K. Chowdhuri, Chairman, Board of Governors, Indian Institute of Coal Management and former Chairman, Coal India Limited, said that R & D is a key to prosperity of any country. He appreciated the R&D work done by CMRI in different fields of mining and exhorted the coal industry to make use of the technologies developed by the institute. He also advised CMRI that the institute should publish its findings in different subjects in the form of book which can be introduced in the curriculum of the mining institute.

On this occasion, Shri Chowdhuri also inaugurated a two-day 'National work shop on Routine Condition Monitoring in Mining Vis-a-Vis Machine Utilization and Cost of Production' organized by CMRI. Earlier, while welcoming the guests and participants, Prof. Bharat B. Dhar, Director, CMRI, outlined the recent achievements of the institute. He also touched upon some of the recent developments such as thick seam mining by cable bolting, high-set remote prop, etc, which are now being utilized by the industry. According to him, the earnings of the institute is increasing day by day. CMRI now perhaps occupies the 4th position within CSIR in terms of earnings.

Dr S.K. Sarkar, Organizing Secretary and Scientist F, CMRI, said, "Breakdown is one of the major contributory factors of low equipment utilization and causes loss of approxi-



Prof. Bharat B. Dhar, Director, CMRI, Dhanbad, welcoming the participants to the 'National workshop on routine condition monitoring in mining' inaugurated on the CSIR Foundation Day at CMRI, Dhanbad

mately one-third of the total available time. The economics of mining may be substantially improved if breakdown is reduced and thereby equipment utilization is improved". According to him, the technique of Routine Condition Monitoring (RCM) offers a way to eliminate or at least reduce sudden breakdown of equipment.

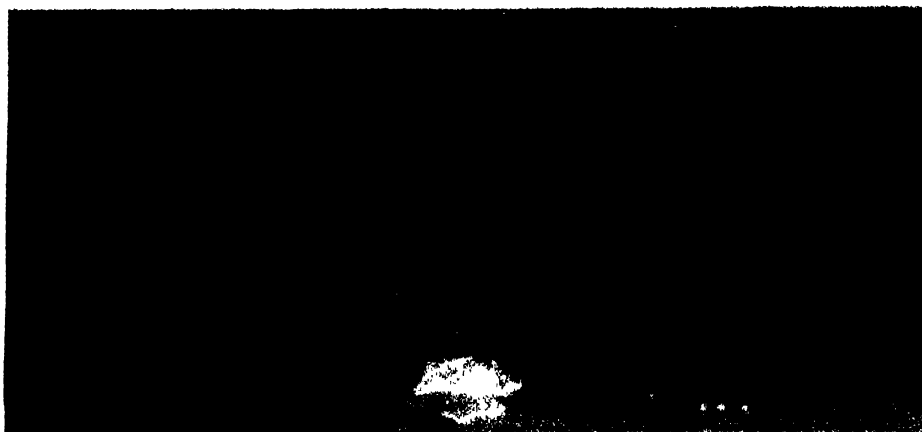
Dr C. V. N. Rao, Director (Tech), BCCL, and Dr M.K. Ghosh, IIT, Kharagpur, also advocated for increasing utilization of the RCM technique for better utilization of machines.

Dr T.N. Singh, Scientist G, CMRI, introduced Shri S.K. Chowdhuri, the Chief Guest. He also spoke on the

accolades received by CMRI scientists and its Director in recent times. Prof. Dhar then presented the Chief Guest with a CMRI memento. Shri A.K. Prasad, Scientist E, CMRI, proposed a vote of thanks. □

Condition monitoring necessary for every system

DR S.Z. Qasim, Member, Planning Commission, and former Director, National Institute of Oceanography, Goa, stressed that condition monitoring was necessary for every system so that it functions smoothly and is cost effective.



Prof. Bharat B. Dhar, Director, CMRI, Dhanbad, presenting a memento to Dr S.Z. Qasim, Member, Planning Commission, at the valedictory function of 'National workshop on routine condition monitoring in mining' at CMRI, Dhanbad

Dr Qasim was addressing the valedictory function of a two-day National workshop on 'Routine Condition Monitoring in Mining' organized by Central Mining Research Institute (CMRI) at Dhanbad on 27 September 1995.

On this occasion, Dr Qasim also appreciated CSIR's recent approach towards science and technology in view of changing scenario of the country.

Earlier, while welcoming the guests and participants, Prof. Bharat B. Dhar, Director, CMRI, and Chairman, Organizing Committee of the workshop, said that routine condi-

tion monitoring of mining equipment is essential to eliminate the breakdown of mining machinery and to improve the economics of mining.

Dr S. K. Sarkar, Scientist 'F' and Organizing Secretary of the workshop, summed up the entire proceedings of the workshop. Dr T.N. Singh, Scientist 'G', CMRI, introduced the Chief Guest and Prof. Dhar presented Dr Qasim with a memento. Shri A.K. Prasad proposed a vote of thanks. At the end of the function, Dr Qasim inaugurated the CMRI Health Club which has been set up for the benefit of the CMRI employees. □

Modern Biology and Bio-medical Applications

MODERN Biology and Bio-Medical Applications' was the title of Prof. G. Padmanaban's CSIR Foundation Day Lecture at National Aerospace Laboratories (NAL), Bangalore, delivered on 26 September 1995. While introducing Prof. Padmanaban, who is the Director of Indian Institute of Science, Bangalore, NAL Director Dr K.N. Raju even confessed that he knew "practically nothing" of modern biology. The lecture was educative, insightful and highly entertaining. In his concluding remarks Dr B.R. Pai aptly summed up the reaction of the audience: "Our knowledge of biology has just leapfrogged from our school days to the 21st century!"

"I'll talk at the base level. I'll assume that you don't know biology", Prof. Padmanaban promised as he began his lecture. The story of modern biology opened with the discovery of the double helix by Watson and Crick and went on to describe the mechanisms involved in the transfer of genetic information. "All

life processes", Prof. Padmanaban explained, "can be reduced to chemical reactions catalysed by proteins". So, if one saw an unusually "fine-tuned nose", it must be because the extent of expression of the nose-keeping genes was a little different in this case. "The amount of protein produced must have been different", he said.

As the lecture progressed, and as Prof. Padmanaban opened up much to the delight of the audience, a few facts became immediately apparent even to the uninitiated: (a) modern biology can now hardly be distinguished from chemistry and (b) some of the most exciting events in science are currently taking place in biology.

One of the highlights of the lecture was Prof. Padmanaban's introduction to biotechnology. "Biotechnology is age-old. We have been growing plants, brewing beer, making *idlis* and *dosas* for as long as we can remember. So what's new?" he asked. The breakthroughs, the speaker explained, were in the areas

of (a) development of plant and tissue culture (b) hybridoma (producing antibodies in a test-tube) and (c) genetic engineering — 20 years ago the gene was a black box! "Today, gene is an organic chemical which can be transferred from one organism to another", he added.

Prof. Padmanaban then went on to discuss the advances in biotechnology with special reference to health. Talking of genetic disorders such as thalassemia, he said that there was real hope that they could be successfully treated in the next decade by a correction of the DNA deletions. For diabetics, genetic engineering might make it possible "to fool bacteria to produce human insulin" because "like humans, bacteria too are fickle-minded"! Prof. Padmanaban also talked of the tremendous possibilities of using DNA probes: "We could screen whole populations to predict the future victims of muscular dystrophy; we could even undertake prenatal diagnosis!" In fact, future questions in this area might well be more *ethical* than *technical*. "Look, how do we abuse even the relatively trivial information that an offspring is likely to be female?" he questioned. What would we do, Prof. Padmanaban asked, if we had more information about the physical appearance or behavioural aspects of a future offspring? What would we do if we could 'genetically tailor' the attributes of an unborn baby? And what would happen if a wrong experiment unwittingly created monstrous Frankensteins?

Indeed, Prof. Padmanaban's lecture was just as notable for its many asides, homilies and humour. Talking of recessive diseases and the need for carrier analysis the speaker remarked: "Given the high inbreeding in South Indian populations, carrier analysis is probably more important

than matching horoscopes!" Talking of the advances in virology, he said, "With a drop of blood, it is now possible to identify practically any infection. That's why medical diagnostics is today a billion dollar industry". Talking of rational drug design, he said, "It used to be a hit and miss affair and successful drugs were often the outcome of serendipity. But today we start with computer-generated candidate molecules which are sure to hit identified hot spots hard!" Talking of advances in polymerase chain reactions, Prof. Padmanaban said that they offered dramatic advances in DNA magnifications and testing sensitivity. "A hostile intruder could be spotted almost as soon as it makes its appearance. Imagine how much that will help clinical treatment!" he exclaimed and went on to speak on cancers, protein pharmaceuticals, four winged flies and litigation columns in biotechnology journals. He also spoke candidly: "We scientists make diagnostic kits which work wonderfully in labs but fail unfailingly in the field!" □

RRL-Bhopal celebrates Foundation Day

INDIAN R & D has a bright future in view of the changing scenario of trading to entrepreneurship. CSIR laboratories must encash on these favourable changes if CSIR has to survive in the emerging global competition. Speaking on the occasion of the Foundation Day of CSIR on 26 September 1995 at Regional Research Laboratory, (RRL), Bhopal, Dr G.S. Sidhu, Former Director General, CSIR, made these observations while delivering the lecture 'The Changing Environment for Research and Development in India'. Tracing the nemesis of scientific base in the industry, he called for professional-

Foundation Day celebrated at RRL-T

THE Regional Research Laboratory, Thiruvananthapuram, (RRL-T) celebrated the CSIR Foundation Day on 26 September 1995 by observing 'Open Day' for the students and the public. Over 7000 students from the colleges and high schools visited the laboratory during the day. In the commemorative function held in the evening, Dr A.D. Damodaran, Director, RRL-T, addressed the invited guests, members of the staff of the laboratory and their family.

In his speech he highlighted the proposed changes in the strategies of the CSIR's industrial research keeping in mind the needs of the nation and changes in world scenario and elaborated on the preparations made by the laboratory for realizing its potential towards building the new CSIR. In the function, mementoes and prizes were also distributed to the staff and their children respectively. □



A group of college students observing the various properties of a superconductor prepared at the Regional Research Laboratory, Thiruvananthapuram, during the 'Open Day' of the Laboratory to celebrate the CSIR Foundation Day

ism, modern R & D management and understanding of Intellectual Property Rights related issues. He cited the example of Light Combat Aircraft project and mentioned that investments on indigenous R & D were equivalent to the prices paid for the imported R & D components. Modern biotechnology and microelectronics are examples of restrictive technology transfer. Amongst developing countries India is advanta-

geously placed to develop its own technologies. He stressed the need for critical self-appraisal and attitudinal change on the part of the R & D laboratories in the emerging scenario of global competition and world market.

Introducing Dr. Sidhu as an eminent technologist in the field of organic chemicals, drugs and pharmaceuticals, and pesticides,



Dr G.S. Sidhu, Ex-DG, CSIR, delivering the lecture 'Changing Environment for R & D in India' on CSIR Foundation Day at Regional Research Laboratory, Bhopal

Prof. T.C. Rao, Director, RRL-Bhopal, mentioned that it was during Dr Sidhu's tenure as DG, CSIR, that the foundation of RRL- Bhopal was laid.

During his welcome address Prof. T.C. Rao mentioned that the laboratory has achieved significant technology/product development in the fibre reinforced plastic (FRP) gear cases for traction motors of locomotives, the wood substitute products, introduction of washing techniques like Vorsyl Separator to coking coal in an operating plant and metal matrix composites (MMCs) to automotive components and other applications.

FRP gear cases have undergone over one year of field trials in South-Central Railway, he stated. Building Materials Technology Promotion Council, Government of India, is guiding the efforts of marketing the wood substitute products developed by RRL. Wasteland development through flyash utilization project carried out by the laboratory at NTPC, Rihand Nagar, has provided a strong basis for embarking on similar projects related to bulk utilization of flyash in land reclamation at other sites in vicinity of power plants in the country.

In his Presidential address Dr Ram Prasad, DG, MAPCOST, mentioned that CSIR is a pioneering S & T establishment of the country. He called for intensive R & D efforts to address the regional needs which are unique for M.P.

On this occasion, the Chief Guest also gave away prizes to the winners for various competitions held for the children of the laboratory staff. Shri P.D. Ekbote, Scientist, conducted the programme and Dr Kunal Basu, Deputy Director, proposed the vote of thanks.

RRL also observed 'Open Day' on this day for students and public during which the laboratory facilities and activities were displayed. Over 500 persons visited the laboratory on this day. □

Obituary

S. Panchapakesan

THE man with gentle steps but with lion's voice, highly knowledgeable but unassuming personality, Shri S. Panchapakesan,

Scientist F of Computer Support & Services Division of National Aerospace Laboratories, (NAL), Bangalore, is no more. He was killed in a road accident on 30 September 1995. Born on 20 February 1940 in the village of Thirvizhimizhalai, Thanjavur District of Tamil Nadu, Shri Panchapakesan was the youngest in a family of five brothers and two sisters. He graduated from the Annamalai University in 1964 with a post graduate degree in statistics and joined NAL on 3 June 1965 and since then he grew with the organization. Shri Panchapakesan is considered to be one of the best in systems software in India. Through his unstinted enthusiasm he has been responsible in the selection of computing equipment and software developments both inside and outside NAL. In those early 80s when computer technology was not as common as it is today, he developed several software packages for the first time like single pass and two pass assemblers for the Intel 8080 microprocessor and also drivers for interfacing input/output devices to these microprocessors.

Shri Panchapakesan's significant contribution to CSIR has been the development of the systems report for configuration of finance, accounts, etc., which was widely circulated to all CSIR laboratories. Till the day of his death he was involved in the computerization activities in collaboration with Deputy Financial Controller of CSIR. On the academic side, Shri Panchapakesan was constantly helping the various universities in the South in computerization, delivering special lectures, etc. Out of love for students, he has been guiding about 50-75 students every year in their project work.

Shri Panchapakesan has been the typical example of a simple and de-

voted person. He was a very friendly person and was liked by all in the community. His wife, amidst her sorrow and gloom, readily agreed to donate his eyes to the eye bank of Lion's club! Panchapakesan leaves behind his wife and two daughters. □

Appointment

G.C. Mishra

DR G.C. Mishra, Scientist, Institute of Microbial Technology, Chandigarh, has taken over as Director, National Facility for Animal Tissue and Cell Culture, Pune, with effect from 1 September 1995.

Deputation

Ecological Engineering for Waste Water Treatment and Resource Recycling

EVERY water body has its own capacity to maintain its natural state through self purification process. However, when the discharge of pollutants is heavy, the process of self purification of water bodies is adversely affected and the water remains polluted. The EPS-US has listed 129 pollutants occurring in industrial waste waters. Attention has been focussed on heavy metals as environmental pollutants which cause many serious ailments. For example, the occurrence of 'Itai-Itai' and 'Minimata' diseases is known to be caused by Cd and Hg poisoning, and chromium and nickel are potential carcinogens which enter into streams from various industrial effluents.

Dr Kaiser Jamil, Head, Biology Division of the Indian Institute of Chemical Technology (IICT), Hyderabad,

was an invited participant to the "2nd International Conference on Ecological Engineering for Waste Water Treatment and Resource Recycling" which was held at the Centre for Ecological Engineering in Zurich, Switzerland, from 18 to 23 September 1995. About 150 participants from 22 different countries participated. Dr Kaiser Jamil presented her work on 'Aquatic plants for waste

water treatment and resource recycling'.

Aquatic weeds like *Eichhornia crassipes*, *Pistia stratiotes* and *Lemna minor* have attracted much attention in the recent times for their role in removal of heavy metals and organic pollutants from the water bodies.

The experiments carried out by IICT have demonstrated that the

New Publication

Ecological Engineering for Waste Water Treatment and Resource Recycling

SHRIMATI K. KAMRAN, Secretary, Commerce and Industry, Government of India, has presented a monograph titled 'Ecological Engineering for Waste Water Treatment and Resource Recycling' to the President of PTC (India) Advisory Committee, released the monograph with that purpose. The monograph was presented at PTC (India) Advisory Committee (PTC-India) on 7 August 1995. The monograph contains project profiles of 30 cottage scale CSIR technologies which could be

employed under PTC (India) Advisory Committee. The monograph contains project profiles of 30 cottage scale CSIR technologies which could be employed under PTC (India) Advisory Committee. The monograph was presented at PTC (India) Advisory Committee (PTC-India) on 7 August 1995. The monograph contains project profiles of 30 cottage scale CSIR technologies which could be



Shrimati K. Kamran, Secretary, Commerce and Industry, Government of India, presenting the monograph to the President of PTC (India) on 7 August 1995.

Announcement

Special Issue of *Indian Journal of Biochemistry & Biophysics (IJBB)*

THE December 1995 issue of IJBB is being brought out as a special issue which contains a spate of original research articles dealing with the advances in ribosomology, role of Elongation Factor EF-3 during translation, a unique location of EF-Tu binding on ribosome, DNA regulatory elements in the transcription of β -amyloid precursor protein implicated in Alzheimers disease, Tat-mediated transcriptional activation in HIV - 1, construction and expression of viral fusion proteins, PCR based diagnostic test for tuberculous pleural effusion, designing peptides with improved IgG binding properties, homology and conserved structural features of 2S coding regions of *Brassica* species, nucleic acid-protein inter-

action studies by physical methods, molecular mechanics studies of homopolymeric and mixed sequences, intra- and interloop interactions within telomeric DNA, codon usage, role of neighbouring sequences and contextual constraints. The guest editors of this special number are Prof. Maharani Chakravorty (Banaras Hindu University, Varanasi) and Prof. R.K. Mandal (Bose Institute, Calcutta).

The special issue contains 172 pages and is priced at Rs 80. Orders for the special issue may be placed with the Sales and Distribution Officer, Publications & Information Directorate, Dr K.S. Krishnan Marg, New Delhi-110012, in the form of a money order or crossed cheque or demand draft payable to Publications & Information Directorate. □

Award Scheme for 1994-95 for writing an original book on technology titled *Koela Khanan Vijnan Evam Takneek* in Hindi.

This Prize of the Ministry of Home Affairs, Government of India, was presented to him by Dr Shankar Dayal Sharma, the President of India, at a glittering function organized at Rashtrapati Bhawan in New Delhi on 14 September 1995.

The book covers all aspects of coal mining. The language of the book is Hindi with local words and acceptable English terminology of coal mining. The level of the subject matter is upto degree and professional certificate of competency of the mining examination.

Dr Singh, who is an acclaimed scientist in mining science, has developed a number of mining technologies which are now being successfully applied to exploit coal, particularly from thick seam mines, namely, wide stall method of mining, mechanized depillaring of thick coal seam with cable bolts, etc. □

aquatic weeds like *Eichhornia* and *Pistia* have tremendous biological capacity to remove dissolved toxic organic and heavy metals from aquatic environments and also detoxify the aquatic environment by physiological mechanisms. Step-wise lagoon systems were designed for detailed trials for removal of metal pollution by this novel approach. □

Honours & Awards

T.N. Singh

DR T.N. Singh, Scientist G, Central Mining Research Institute, Dhanbad, has recently bagged the Second Prize under the Indira Gandhi Rajbhasha



Dr T.N. Singh (extreme right) receiving the Raj Bhasha Award from Dr Shankar Dayal Sharma, the President of India, for his book in Hindi at a ceremony at Rashtrapati Bhawan, New Delhi

Printed and Published by Dr G.P. Phondke, Director, Publications & Information Directorate (PID), Dr K.S. Krishnan Marg, New Delhi - 110 012
Printed at PID Printing Unit

Editors : Dr B.C. Kashyap, Dilip M. Sahni and Madhu Sahni
Phone: 5786301 Gram: PUBLIFORM

Production : Kaushal Kishore
Telex: 031-77271
RN 4512/57

Annual Subscription : Rs. 60
Single Copy: Rs. 3.00
E-mail: pid@srineta.comet.in. Fax: 5787062

CSIR

NEWS


VOL 45 NO 22 30 NOVEMBER 1995

"Light Combat Aircraft now has its wings!"

FORTY seven months ago a National Team was set up under the leadership of Dr K.N. Raju, Director, National Aerospace Laboratories (NAL), Bangalore, to design, develop and fabricate a few sets of CFC wings for the Light Combat Aircraft (LCA). There were several question marks when the team started its work. Do we have the capability to build these extremely complex

wings? Can the team, comprising scientists and engineers from HAL, ADA, NAL, IISc and other organizations work together in harmony and in the face of such demanding challenges and deadlines?

The first set of fully tested LCA wings is now ready and already installed on the aircraft's fuselage. The

wings were formally handed over at a brief function in the ADA Seminar Hall on 21 October 1995. The "wings" (actually a mounted photograph of the wings) were first handed over by Shri K.V. Srivatsan, GM (D&D), HAL, and Associate Leader of the National Team, to the National Team Leader, Dr Raju; Dr Raju in turn handed them over to Dr A.P.J.

IN THIS ISSUE

Visit of Parliamentary Standing Committee to NIO	338
Super Strain Gauge	340
Centre for Cellular & Molecular Biology, Hyderabad R&D Highlights : 1994-95	341
Science and Technology Development Strategies in India and China	349
Intensive Course on Molecular Modelling	351



Dr A.P.J. Kalam (left), Scientific Adviser to Raksha Mantri, Ministry of Defence, on the occasion of unveiling the photograph of Light Combat Aircraft's wings

Abdul Kalam, SA to RM and DG-ADA; and Dr Kalam lost no time in handing the wings over to HAL. Dr C.G. Krishnadas Nair MD, HAL (BC), received the wings on behalf of HAL.

It was a very special moment for the National Team especially for Dr Raju. "We are meeting here today to celebrate the joy of achievement", Dr Raju said as he personally thanked every one of his colleagues for their cooperation and support and described the nature of their involvement. And an exultant Dr Nair remarked: "LCA now has its wings, and soon it will fly!"

By any yardstick the successful development of the LCA CFC wings is an outstanding technological achievement. Although there was a 10 month slippage in the time schedule, no one in the world has built CFC aircraft wings for the first time in a shorter time span. British Aerospace, one of the consultants of the team, acknowledged this while congratulating the team for its "enthusiasm, expertise and innovation". "Not many countries in the world today can build such a wing", said a delighted Prof. R. Narasimha, "and we should feel happy and proud of this achievement".

Dr A.P.J. Abdul Kalam, who flew in from Delhi to review the progress of the LCA programme and to receive the wings, was equally delighted. Recalling a 1991 meeting in Delhi when the momentous decision to choose the composite route for the wings was taken, Dr Kalam admitted that "we all had our doubts then" and congratulated the National Team for successfully laying these apprehensions to rest. Dr Kalam also repeated his assertion that the "programme is always bigger than the individual" and fondly recalled how his mentor Prof. S. Dhawan, then Chair-

man, Space Commission, once told him: "I will work for you. We will all work for the Indian space programme!"

Dr Kota Harinarayana, PGD, ADA, and Shri K.V. Srivatsan also spoke briefly. Turning to Dr Raju, Dr Kota said, "You have thanked everyone involved in the project, but the one man to be really thanked is you!" Dr Kota also expressed his satisfac-

tion that the CFC Wing National Team had also vindicated the National Team concept. In his vote of thanks, Dr B.R. Somashekar complimented the administrative machineries at NAL, ADA and HAL for their speedy award of contracts and remarked that the project demonstrated that "scientists too can be great managers". □

Visit of Parliamentary Standing Committee to NIO

THE Parliamentary Standing Committee on Science, Technology, Environment and Forests visited the National Institute of Oceanography (NIO), Dona Paula, Goa, on 18 September 1995. The team comprised the following members of Parliament: Shri Satchidananda, Chairman; Dr Ranbir Singh, Member; Smt. Bhavana Chikhalia, Member; Smt. Saroj Dubey, Member; Shri K. Rahman Khan, Member; Dr D. Masthan, Member;

Shri W. Kulabidhu Singh, Member; Pt. Vishwanath Sharma, Member; Shri Ram Kirpal Yadav, Member; and Shri P. Kumarswamy, Member.

At NIO the following dignitaries were also present during the visit: Dr A.E. Muthunayagam, Secretary, Department of Ocean Development (DOD), Government of India, New Delhi; Dr J.S. Raju, Director General (STQC) & Adviser, Department of Electronics, New Delhi, and Dr



The members of the Parliamentary Standing Committee being apprised of the research activities on board ORV Sagar Kanya

S.A.H. Abidi, Director, Department of Ocean Development, New Delhi.

Dr E. Desa, the Director, NIO, apprised the visiting Parliament members about the R & D activities of the institute. The members were also briefed about the genesis of the institute, its charter, organizational structure, manpower and budget. Dr Desa highlighted the R & D achievements and the services rendered to various industries and organizations through sponsored and consultancy programmes.

Dr S.N. D'Souza, Scientist, NIO, briefed the honourable members about the special cruise (No.105 A) of *ORV Sagar Kanya* to Lakshadweep and Dr M. Sudhakar, Scientist, NIO,

gave a status of the programme on polymetallic nodules.

Dr A.E. Muthunayagam, Secretary, DOD, provided a summary of programme undertaken and proposed by the Department of Ocean Development.

The committee members later visited the ship *ORV Sagar Kanya* at Marmugao. Some of the visiting members participated in the *Sagar Kanya* cruise 105-A from Marmugao to Lakshadweep. The Chairman of the visiting Parliamentary Standing Committee, Shri Satchidananda, expressed appreciation on the performance of the various R & D activities of the institute and the arrangements made for the visit. □

were being made to raise this figure to \$ 50 million by 2001 AD.

In his Presidential address, Dr G. Prabhakara Rao, Acting Director, CECRI, traced the history of CSIR since its establishment in 1942 and highlighted its achievements as a premier scientific body in the country. He pointed out that CSIR has wide charter of functions, including promotion, guidance and coordination of scientific and industrial research, collection and dissemination of information on research and development, funding of laboratories to further scientific and industrial research and exploitation of research results for the technological development of the country.

Over the years CSIR had performed its functions in tune with national needs and priorities. Today, CSIR has to compete with the world market in R&D research due to liberalization and globalization of the Indian economy. The activities of CSIR have been geared up to make research a business. Dr Rao said that that was an occasion to re-dedicate scientists to the cause for which CSIR was founded and to fulfill the tasks before the country.

Dr Rao also used the occasion to highlight the achievements of CECRI over the years as one of the leading CSIR laboratories in electrochemistry in the entire South East Asian region for the development of electrochemical science and technology. CECRI's contributions, he pointed out, have been significant in the transfer of technologies to both small and large scale industrial sectors in rural areas. He said that CECRI, which would be celebrating its golden jubilee in two years, was preparing a master plan for further modernization of its laboratories, better infrastructure for the institute

CECRI celebrates Foundation Day

THE CSIR Foundation Day Lecture by Dr M.K. Chandrasekharan, Head and Coordinator, School of Biological Sciences, Madurai Kamaraj University, Madurai, organization of 'Open Day' and 'Exhibition', Essay competition for children of staff, Young scientists' seminar, and presentation of awards for best technologies were the highlights of CSIR Foundation Day celebrations organized at Central Electrochemical Research Institute (CECRI), Karaikudi, on 26 September 1995.

Delivering the Foundation Day Lecture, Dr Chandrasekharan pointed out that science and technology could flourish only in a society in which university teaching and research flourished. He said that it had become fashionable to blame CSIR for building national science laboratories and drawing the best scientific talent from universities. He argued

that such a parallel formation of science institutes in Germany had not affected the universities. The universities prided upon themselves with the fact that they bagged the majority of Nobel Prizes. Dr Chandrasekharan was therefore keen that Indian universities should never give up scientific research and development efforts. The universities had traditionally looked up to the University Grants Commission and CSIR for funding their modest research undertakings and for junior and senior research fellowships. He hoped that CSIR, after having laid the foundations of fundamental research and science base in universities, would also continue to support in future curiosity-based science of the highest order in the universities.

Dr Chandrasekharan said that CSIR's global earnings from royalty, consultancy and other services amounted to \$2 million and attempts

R&D Flash

Super Strain Gauge

THE strain gauge is a strain-sensitive resistor. Its resistance changes as a function of applied strain when cemented to a stressed member. This behaviour makes it useful in the field of stress analysis, physical measurements and testing, transducer manufacture and biomedical instrumentation.

The conventional types of strain gauges consist of metal wire/foil or semiconductor. Metal strain gauges have gauge factors between 2 and 5 whereas for semiconductor strain gauges, the typical gauge factor is higher, typically between 45 and 175, but is temperature-sensitive.

The strain gauges on alumina substrates based on thick film technology developed by scientists of Central Electronics Engineering Research Institute (CEERI), Pilani, demonstrate gauge factors typically between 200 and 1000. These are therefore designated as 'Super Strain' Gauge. These gauges show the linear behaviour upto 1000 microstrain and have negligible hysteresis. The temperature dependence is also marginal.

The super strain gauge offers the possibility of bringing a lot of innovations in the strain gauge signal conditioners which provide an analog interface between the sensor and the system they serve. The thick film approach followed for the gauges offers the possibility of mass production and automation. □



Dr M.K. Chandrasekharan of Madurai Kamaraj University delivering the CSIR Foundation Day lecture at CECRI, Karaikudi



Students viewing the electrochemical products made by CECRI, Karaikudi, during the 'Open Day' observed at the institute on 27 September 1995

and for the scientists residing in the campus.

Dr Chandrasekharan gave away cash awards to the children of the staff who had excelled in the 12th public examinations and in the essay competition held in connection with CSIR Foundation Day. Earlier, Dr A.S. Lakshmanan, Head, Electrochemical Materials Science Division, CECRI, welcomed the gathering. Shri M.R. Radhakantha, Administrative

Officer, CECRI, proposed a vote of thanks.

As a part of the celebrations, 27 September 1995 was declared as 'Open Day' for the institute. The institute was kept open to the public and the student community providing them an opportunity to see its research activities. About 5,000 people, including students, visited the institute on that day. □

Centre for Cellular & Molecular Biology, Hyderabad

R & D Highlights : 1994-95

The Centre for Cellular & Molecular Biology (CCMB), Hyderabad, conducts basic research in chosen areas of modern biology and seeks potential applications thereof. Its activities in this endeavour range from fundamental research to commercial applications and in societal and biomedical sectors. The research programmes pursued during the year 1994-95 and the salient findings under some of these are highlighted below.

Biomedicine and Biotechnology

The tandem repetitive, minisatellite multi-locus probe, developed in Lalji Singh's group earlier, has been designated the *Bkm* probe and used as a universal probe for DNA fingerprinting. This indigenously developed probe has been used extensively in our country for forensic purposes, paternity disputes, wild life and silk moth fingerprinting.

Multi-locus probes, unfortunately, cannot be used in the case of confounding situations, such as gang rapes or for establishing a database of

convicted criminals. For this and many such purposes, single locus probes are more useful. Singh's group has recently succeeded in developing one such single locus probe, using the strategy with the tandem repeat "core sequence" of *Bkm*, consisting of GATA repeats, which hybridises to several polymorphic locations in the human genome. Such a polymorphic, *Bkm* positive fragment from human DNA has been cloned and screened and the positive clones isolated and designated *Bpf* 3.8, which proved to be human specific and single locus in character. This would thus be valuable in a variety of situations, such as those cited above.

Ashok Khar's group has shown that interleukin-12 activates natural killer cells leading to the production of interferon-gamma, which in turn participates in causing the death of tumour cells. Killing of cancer cells was shown to occur both through necrosis and apoptosis. The former disrupts the tumour cell membrane and lyses it, while the latter causes DNA fragmentation in the tumour cell. Induction of apoptosis, which is

specific and programmed in the genetic make-up of the cell, can be used in the cancer immune therapy.

Balasubramanian's group has further investigated the molecular epidemiology of the smoke-cataract connection. Cataractogenesis of smoke constituents appears to involve oxidative stress generated by the reactive oxygen species in the smoke condensates and also adduct formation and condensation of DNA by the polynuclear aromatics present in the smoke.

Luthra and Balasubramanian have been able to identify several pigments largely derived from modifications of the aromatic amino acid side chains of crystallin that accumulate in the eye lens with age and in cataract. Several of these produce oxidative stress to the lens through photodynamic mechanism.

Uma, Sharma and Balasubramanian have analysed the structural properties of keratan sulfate proteoglycan, the major constituent of the cornea, and suggest that it acts as an excellent filler and hydrating agent in this ocular tissue.



Dot-blotting RNA samples for detecting expression of heat shock proteins

Genetics and Evolution

Gowrishankar's group, working on the genetics of osmoregulation in *E. coli*, has shown that the P1 promoter of the osmotically regulated *proU* promoter is recognised by RNA polymerase bearing the stationary-phase sigma factor, both *in vitro* and *in vivo*. They have also shown that the synthesis of polyamines from arginine is inhibited in wild-type cells at high osmolarity and that this is a contributing factor in osmotolerance. Also, the regulatory protein, FNR, which functions as a dimer in anaerobic gene regulation, is functional as a monomer in osmoregulation.

The response of fungi to plant pathogens is an area of particular interest pursued by Kasbekar. His group had earlier implicated the role of membrane sterols for this purpose and cloned and sequenced the *erg3* gene, which encodes the sterol biosynthetic enzyme, sterol C-14 reductase. They had also found that *erg3* mutations switched the fungus from sensitivity to the tomato phytoalexin, tomatine, to sensitivity to the pea phytoalexin, pisatin. During the year, Kasbekar's group devised a PCR strategy to isolate the sterol C-14 reduc-

tase gene from the pea pathogenic fungus, *Nectria haematococca*, and used the cloned gene to construct *erg3* mutants and antisense approaches, in order to examine whether the *Nectria* mutants switch hosts from peas to tomatoes.

Shivaji's group has been attempting to understand the molecular basis of the adaptation of Antarctic bacteria to low temperatures. They showed that such psychrotrophic bacteria contain cold-specific promoters that are functional only at low temperatures and also that they have

genes that impart the ability for cold-adaptation. Efforts this year have focused on the localisation of the cold-specific promoters and cold-adaptive genes. In collaboration with Mohan Rao, they have characterized and compared the pigments that occur in many strains of Antarctic bacteria with those in mesophiles. Such a comparison reveals that the chromophores present in both types of bacteria are the same and that they are localised largely in the membrane region.

Cell Biology and Development

Shivaji's group has been involved in attempts to understand the molecular aspects of sperm motility. During the year, they have looked at the phosphorylation of the membrane proteins of the spermatozoa and found that such phosphorylation depends on whether the cell was immature or mature. Relevant kinase enzymes and the sites of phosphorylation are being characterized.

Gupta's group has continued its investigations on the role of the female sex hormone estradiol, which regulates keratin gene expression. They have shown that this regulation



Operating the Phosphor Imager

is at the transcriptional, post-transcriptional and translational levels. The hormone-receptor complex acts as a transcription factor. Estradiol is also seen to initiate a cascade of non-genomic effects, such as increased calcium influx and keratin phosphorylation. The increased calcium activates calcium-dependent transglutaminase, which helps in cross-linking the keratin polypeptides, ultimately leading to programmed cell death.

Molecular Biology

Parnaik's group has established that activation of the A-type lamin gene occurs early during embryonic liver development. It is interesting to note that while the B-type lamins seem adequate in undifferentiated cells, lamin A is expressed only in differentiated cells. They have been studying the regulation of the lamin A gene to address this question. A large genomic clone, containing the 5' control region of the gene, has been isolated and is being sequenced.

Chatterji's group has continued its work on transcription and, during the year, has shown that the stringent factor, *ppGpp*, regulates the gene expression in bacteria by directly interacting with RNA polymerase. It has

been possible for them to identify a strain of *E. coli* that does not show a stringent response; RNA polymerases from such strains do not bind to *ppGpp*.

Vijaya Gopal and Chatterji have mutated specific site-directed, N-terminal domain residues of the RNA polymerase sigma factor, which has led them to understand how this protein regulates through hydrophobic interactions between two distant domains. A mutation in the C-terminal domain, on the contrary, alters the disposition of the docking helix of the helix-turn-helix motif, thereby resulting in reduction in the rate of initiation of transcription.

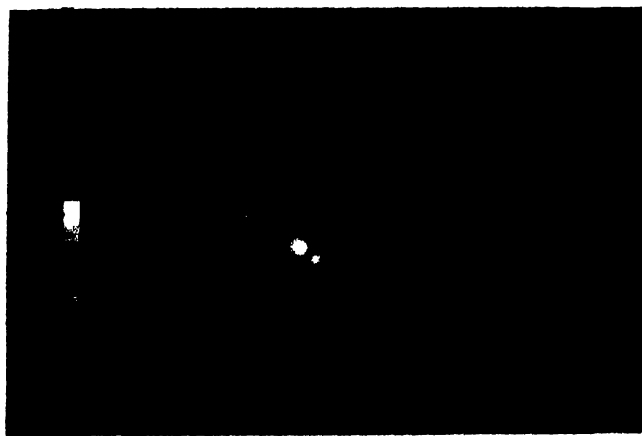
Purnima Bhargava, in the group, has been looking at the basic mechanism of the elongation step of transcription. Choosing eukaryotic DNA, both *in vivo* and *in vitro*, she has been attempting to understand the mechanism by which polymerases make

their way through nucleosomes. She has used the indirect end-labelling approach to look at the *in vivo* footprints of the various yeast genes and reconstitute variously designed templates *in vitro*, in order to monitor their transcriptional activity.

Chanshyam Swarup's group had earlier identified a nuclear matrix associated protein tyrosine phosphatase, PTP-S, which may play a role during the G₀ to S event of the cell cycle. They have now showed that there are four forms of PTP-S that arise due to alternative splicing from a single gene. One of the two major variants, PTP-S2, binds to DNA, but another splice variant, PTP-S4, does not; also the relative levels of their expression differ in cells and tissues. Whereas all four forms are expressed in rat and mouse cells, only two are expressed in human cells — a rare phenomenon of specific splicing, which might be one of the means of creating gene diversity during evolution. During the year, the group also showed that the nuclear matrix, which constitutes the structural framework of the nucleus, has tyrosine kinase activity, which showed cell cycle dependent



Spinning down cells in a centrifuge



Optical section of HeLa cells transfected with *PTP-S2* and visualised using a monoclonal antibody

changes and was higher in virus transformed cells. This suggests a role for this kinase in cell proliferation. One such kinase, associated with the nuclear matrix, was identified as *Lyn*, a member of the *Src* family.

The plant group of Ramesh Sonti and Imran Siddiqi is now well set with the commissioning of the green house, plant growth chambers and other equipment. During the year, Sonti and associates have applied molecular genetic methods to understand the virulence of the bacterial blight, *Xanthomonas oryzae* (*Xoo*), on rice. They have isolated pathogenicity deficient mutants and are cloning the genes that are defective by functional complementation. RFLP analysis on *Xoo* isolates from 20 different locations across the country suggests to them that the majority of the *Xoo* population in India consists of descendants of a single clone. Probes used here appear worthy of use for determining bacterial pathotype.

Biochemistry and Biophysics

Mohan Rao and associates have been pursuing their studies on the chaperone role of alpha-crystallin, the major cortical protein of the human eye lens. Alpha-crystallin, they show, is able to offer appropriate hydrophobic surfaces, particularly at temperatures above 30°C, and thus aid the rapid refolding of the other crystallins. This temperature sensitivity of the chaperone activity of alpha-crystallin suggests that a structurally perturbed state might be involved in the action. The finding appears relevant in the context of "chaperone diseases", of which cataract might be one.

Amit Chattopadhyay has continued the use of wavelength dependent fluorescence (REES) to study membrane penetration depths of

membrane-bound peptides, such as melittin and the channel peptide, gramicidin. These studies reveal the role that membrane cholesterol plays in the change in channel function.

Nagaraj and associates have made further advances in their efforts to synthesise a broad spectrum antibacterial peptide with minimal effects on human cells. Dhople and Nagaraj have generated several analogues with bacteriolytic activity, by making minimal changes in an otherwise inactive 16-residue peptide. Joseph and Nagaraj have delineated the realignment role that is served by the fatty acyl derivative groups attached to membrane active peptides.

Applied Front

Several projects of applied and developmental nature have been taken up during the year. The technology of DNA fingerprinting is being applied successfully to monitor the genetic quality and individuality of wildlife, such as the tigers in various Indian zoos. This technology is now also being used to type important silk worm races, in collaboration with the Central Silk Board. A single locus DNA probe has been developed, which should aid forensic medicine and the creation of DNA fingerprint databases in the country. A salt sensitive expression vector has been developed and successfully used to clone and express six diverse genes. This expression vector, the patent for which is being filed, is expected to be of importance in recombinant DNA technology. In a collaborative programme with our sister institution, the Indian Institute of Chemical Technology, Hyderabad, a convenient and simple method for producing chirally pure L-aspartic acid has been achieved, using immobilised bacterial cells. This, along with the

current efforts on enzymatic peptide coupling, is of great value in the manufacture of the artificial sweetener, aspartame (the chief constituent of *Sugar Free*TM and *Equal*TM), which is being imported at present. An elegant and cost-effective method has been developed for the production of the ribonuclease inhibitor, RNasin. This material has been handed over to a commercial firm in Bangalore for marketing. Our efforts on a cost-effective fish feed have continued to be successful. The technology is ready for immediate commercialisation.

A novel and welcome feature during the year has been the interaction with industry. This has taken the form of memoranda of understanding with pharmaceutical firms, whereby the CCMB is training their personnel in carrying out tests for screening of anti-cancer drugs, using enzyme assays and tumour cell lines and in the research and production of genetically engineered proteins such as hepatitis B antigen and interferon-alpha. Further interaction with some other firms is in the process of discussion and negotiation.

Science is International !

Internationally, CCMB is an associate of the Oxford International Biomedical Centre and has collaborative research agreements with the National Institutes of Health, Bethesda, MD, U.S.A., the National Institute of Genetics, Mishima, Japan, and the Imperial Cancer Research Fund, London, UK. CCMB is one of the fifty member institutions of the UNESCO global network in molecular and cell biology and a South Centre of Excellence of the Third World Academy of Sciences.

The Centre attracts workers from overseas who come and work here

on research programmes of mutual interest. Some such scientists were Prof F Yasuzumi, University of the Ryukyus, Okinawa, Japan, Prof V S Ananthanarayanan, University of Western Ontario, Hamilton, Canada, Dr Song Ping, Wu Han University, Wu Han, China and Dr Arpita Pandya, Oxford University, Oxford, UK.

CCMB has hosted three international events during the year. The first was an informal satellite meeting to the International Conference on Eye Research, held in September 1994, where over 30 scientists from six different nations participated. The second was the sponsoring of the III International Conference on DNA Fingerprinting in December 1994, wherein about 250 people from all the continents in the world participated. The last was the India-Japan Workshop on Transcription in Prokaryotes, which had 20 students and a faculty of scientists from Japan, USA and India.

Honours and Awards

Dr Ramesh K Aggarwal, Fellowship of the International Rice Research Institute; **Prof D Balasubramanian**, Platinum Jubilee Lecture Award, Indian Science Congress Association; Mahender Lal Sircar Endowment Prize, Indian Association for the Cultivation of Science; elected President, Indian Biophysical Society; **Dr D Chatterji**, Visiting Professor, Department of Molecular Genetics, National Institute of Genetics, Mishima, Japan; **Dr M K Chattopadhyay**, Elected Fellow of the Institution of Chemists, India; **Dr J Gowrishankar**, Prof J V Bhat Eureka Forbes Memorial Award in Microbiology; **Dr P D Gupta**, Max Planck Fellowship at the Institut für Experimentelle Endocrinologie, Hanover, Germany for one year; **Sri K Kannan**, Ranked First in

M.Tech. (Biotechnology), Anna University, 1993 (cash prize); **Dr D P Kasbekar**, Rajiv Gandhi Research Grant for Innovative Ideas in Science and Technology for two years (1993-95); **Dr Ashok Khar**, T B Patel Oration Award in Cancer Research; **Dr R Nagaraj**, Shanti Swarup Bhatnagar Prize in Biological Sciences, 1994; **Dr V Radha**, Fellowship of the Italian Association for Cancer Research; **Dr Rajeshwari Ramanan**, Jawaharlal Nehru Award of the ICAR; **Sri C Ramu**, Fellowship for work at EMBL, Heidelberg, Germany; **Dr S Harinarayan Rao**, Raman Research Fellowship (CSIR); **Sri K Manik Rao**, H L N Murthy's Best Glass Blower Prize, CECRI, Karaikudi; **Dr M K Ray**, Visiting Foreign Scientist, National Institute of Basic Biology, Okazaki, Japan; **Smt Gomathy Sankaran**, Gold Medal, Bachelor of Library Sciences, Indira Gandhi National Open University, 1995; **Dr Yogendra Sharma**, Special Invitee, European Union Concerted Action Meeting on Eye Research, Naples, Italy; **Dr S Shivaji**, Selected as one of the 16 participants of the Special Worldwide Antarctic Expedition; **Dr Lalji Singh**, Prof S P Ray-Chaudhuri 75th Birthday Endowment Lecture; **Dr Somdatta Sinha**, Visiting Fellowship of the Jawaharlal Nehru Centre for Advanced Scientific Research, Bangalore; **Sri Ch Sudhakar**, One of 18 invitees to the 1995 AMBO International Training Course; **Dr Ghanshyam Swarup**, Elected Fellow of the Indian Academy of Sciences; and **Dr T A Thanaraj**, Fellowship under the Human Frontier Sciences Programme.

Research Publications

Published

1. Aggarwal, R.K., Majumdar, K.C., Lang, J.W. and Singh, L. (1994). Generic affinities among crocodilians as revealed by DNA fingerprinting using a Bkm-derived

probe. *Proceedings of the National Academy of Sciences, USA*, 91: 10601-10605.

2. Arul, M. (1994). Neural networks for biomedical signal processing. *CSI Communications*, 18: 19-21.

3. Balasubramanian, D. (1994). Molecular epidemiology of cataract. *Journal of Indian Institute of Science*, 74: 545-552.

4. Bhargava, P. (1994). Repairing information lacunae: coupling of transcription with repair. *Current Science*, 67: 10-13.

5. Bhargava, P. (1994). Sigma⁷⁰ of *E. coli*: many more wonders. *Current Science*, 67: 490-491.

6. Bisht, K.S., Revathi, C.J. and Srinivas, U.K. (1994). Differentiation of mouse embryonal carcinoma cells PCC4 by heat shock and the kinetics of induction of heat shock proteins. *Indian Journal of Biochemistry and Biophysics*, 31: 295-301.

7. Chadalavada, S.V.R., Reddy, B.V.B. and Reddy, A.R. (1994). Proline-protein interactions: protection of structural and functional integrity of M₄ lactate dehydrogenase. *Biochemical and Biophysical Research Communications*, 201: 957-963.

8. Chattopadhyay, M.K. (1994). Antioxidants as cardioprotective agents. *International Pharmacy Journal*, 8: 250.

9. Chattopadhyay, M. K. (1994). Cold shock proteins from microorganisms. *Current Science*, 67: 13-14.

10. Das, D., De, P.K. and Banerjee, R. K. (1995). Thiocyanate, a plausible physiological donor of gastric peroxidase. *Biochemical Journal*, 305: 59-64.

11. Devi, L.G. and Shivaji, S. (1994). Computerised analysis of motility parameters of hamster spermatozoa during maturation. *Molecular Reproduction and Development*, 38: 94-106.

12. Devi, L.G., Ahmad, M.B. and Shivaji, S. (1994). Secretory proteins of the hamster cervix, uterus and oviduct: the effects of estradiol, progesterone and testosterone on the proteins secreted into the medium. *The Journal for Steroid Biochemistry and Molecular Biology*, 51: 107-114.

13. Dwivedi, A., Srinivas, U.K., Singh, H.N. and Singh, H.D. (1994). Regulatory effect of external pH on the intracellular pH in alkaliphilic cyanobacteria *Microcystis aeruginosa* and *Hapalosiphon welwitschii*. *Journal of General and Applied Microbiology*, 40: 261-263.

14. **Fatima, S. and Parnaik, V. K.** (1994). Effect of nuclear localization signal-receptor interaction on nuclear envelope-associated ATPase activity. *Indian Journal of Biochemistry and Biophysics*, 31: 449-453.
15. **Gopal, V., Ma, Hui-Wen, Kumaran, M.K. and Chatterji, D.** (1994). A point mutation at the junction of domain 2.3/2.4 of transcription factor τ abrogates productive transcription and restores its expected mobility on a denaturing gel. *Journal of Molecular Biology*, 242: 9-22.
16. **Gopalakrishna, P. and Khar, A.** (1995). Comet assay to measure DNA damage in apoptotic cells. *Journal of Biochemical and Biophysical Methods*, 30: 69-73.
17. **Gouri, B.S.V., Rema, V., Kamalakar, S. and Swarup, G.** (1994). Nucleotide sequence of a cDNA coding for rat hck tyrosine kinase and characterization of its gene product. *Journal of Biosciences*, 19: 117-129.
18. **Gupta, P.D.** (1994). A new enzyme (IGN) that helps to regenerate nerve tissue. News and Views. *Journal of Basic and Applied Biomedicine*, 2: 55.
19. **Gupta, P.D. and Sierralta, W.D.** (1994). Ultrastructural evidence for the presence of crystalline structures in pig vaginal epithelial cells. *Cytobios*, 79: 35-42.
20. **Jayashree, P. and Gowrishankar, J.** (1995). A new phenotype for *sbcB* mutations in *Escherichia coli*: Rex A-dependent increase in plasmid-borne gene expression. *Molecular and General Genetics*, 246: 648-656.
21. **John Bright, J. and Khar, A.** (1994). Apoptosis: programmed cell death in health and disease. *Bioscience Reports*, 14: 67-81.
22. **Kasbekar, D.P.** (1994). Non-degradative pisatin-resistance in *Dictyostelium discoideum*, *Neurospora crassa* and *Nectria haematococca*: similarities and differences. *Journal of Biosciences*, 19: 529-536.
23. **Kasbekar, D.P.** (1994). Induction of pisatin tolerance in *Dictyostelium discoideum* spores. *Fungal Genetics Newsletter*, 41A: 76.
24. **Kausalya, S., Hegde, S.P., John Bright, J. and Khar, A.** (1994). Mechanism of antibody dependent natural killer cell-mediated AK-5 tumor cell death. *Experimental Cell Research*, 212: 285-290.
25. **Kausalya, S., Pardhasaradhi, B.V.V. and Khar, A.** (1995). Conjugate formation between effector and target as a function of cytotoxicity in antibody-dependent killing of AK-5 tumour. *Indian Journal of Experimental Biology*, 33: 161-164.
26. **Krishna, A.G., Balasubramanian, D. and Ganesh, K.N.** (1994). Sugar-DNA molecular recognition: specific interaction of -1,4-glucopyranose chains with DNA in the minor groove. *Biochemical and Biophysical Research Communications*, 202: 204-210.
27. **Kumar, T.K.S., Raman, B. and Rao, Ch. Mohan** (1995). Fluorescent staining for proteins on polyacrylamide gels with 5-dimethylamino-1-naphthalene-sulfonyl chloride (Dansyl Chloride). *Journal of Biochemical and Biophysical Methods*, 30: 79-84.
28. **Kumar, T.K.S., Gopalakrishna, K., Ramakrishna, T. and Pandit, M.W.** (1994). Refolding of RNase A at high concentrations: identification of non-native species. *International Journal of Biological Macromolecules*, 16: 171-176.
29. **Kumar, T.K.S., Subbiah, V., Ramakrishna, T. and Pandit, M.W.** (1994). Trichloroacetic acid-induced unfolding of bovine ribonuclease: existence of molten globule-like. *Journal of Biological Chemistry*, 269: 12620-12625.
30. **Luthra, M., Ranganathan, D., Ranganathan, S. and Balasubramanian, D.** (1994). Protein-associated pigments that accumulate in the brunescent eye lens: identification of a quinoline derivatives. *FEBS Letters*, 349: 39-44.
31. **Luthra, M., Ranganathan, D., Ranganathan, S. and Balasubramanian, D.** (1994). Release of tyrosine in the insoluble protein fraction of brunescent aging human lenses. *Journal of Biological Chemistry*, 269: 22678-22682.
32. **Manna, D. and Gowrishankar, J.** (1994). Evidence for involvement of proteins HU and RpoS in transcription of the osmoreponsive *proU* operon in *Escherichia coli*. *Journal of Bacteriology*, 176: 5378-5384.
33. **Mishra, K., Devi, K. and Parnaik, V.K.** (1994). A conserved epitope on nuclear pore phosphoproteins reflects cell division status. *Indian Journal of Biochemistry and Biophysics*, 31: 243-248.
34. **Mishra, K. and Parnaik, V.K.** (1995). Essential role of protein phosphorylation in nuclear transport. *Experimental Cell Research*, 216: 124-134.
35. **Mukherjee, S. and Chattopadhyay, A.** (1994). Motionally restricted tryptophan environments at the peptide-lipid interface of gramicidin channels. *Biochemistry*, 33: 5089-5097.
36. **Nagesh, N. and Chatterji, D.** (1995). Ammonium ion at low concentration stabilizes the G-quadruplex formation by telomeric sequence. *Journal of Biochemical and Biophysical Methods*, 30: 1-8.
37. **Pandey, S., Karande, A.A., Mishra, K. and Parnaik, V.K.** (1994). Inhibition of nuclear protein import by a monoclonal antibody against a novel class of nuclear pore proteins. *Experimental Cell Research*, 212: 243-254.
38. **Pandit, M.W., Rao, R.S., Rao, S.V.V.S., Rao, G.N. and Krishna, D.M.** (1994). An efficient lagrange interpolation procedure for binding constants of macromolecules. *Bulletin of Pure and Applied Sciences*, 13: 41-49.
39. **Papavinasasundaram, K.G. and Kasbekar, D.P.** (1994). The *Neurospora crassa erg3* gene encodes a protein with sequence homology to both yeast sterol C-14 reductase and chicken lamin B receptor. *Journal of Genetics*, 73: 33-41.
40. **Parnaik, V.K., Vidya, S.J. and Hamid, Q.A.** (1994). Towards understanding lamin gene regulation. *Journal of Biosciences*, 19: 615-628.
41. **Patturajan, M., Chatterji, D. and Rao, G.R.** (1994). Accurate transcription by RNA polymerase II from *Candida utilis*. *Biochemistry and Molecular Biology International*, 33: 901-907.
42. **Pichare, M.M. and Kachole, M.S.** (1994). Detection of electrophoretically separated protease inhibitors using X-ray film. *Journal of Biochemical and Biophysical Methods*, 28: 215-224.
43. **Rachel, A.J., Slovak, M.L., Sen, S. and Srivatsan, E.S.** (1994). Rearrangement of chromosome band 11q13 in HeLa cells. *Anticancer Research*, 14: 1727-1734.
44. **Radha, V., Nambirajan, S. and Swarup, G.** (1994). Subcellular localization of a protein tyrosine phosphatase: evidence for association with chromatin. *Biochemical Journal*, 299: 41-47.
45. **Raman, B. and Rao, Ch. Mohan** (1994). Chaperone like activity and quaternary structure of -crystallin. *Journal of Biological Chemistry*, 269: 27264-27268.
46. **Ranganathan, V. and De, P.K.** (1995). Androgens and estrogens markedly inhibit expression of a 20 kDa

major protein in hamster exorbital lacrimal gland. *Biochemical and Biophysical Research Communications*, 208: 412-417.

47. Rao, Ch. Mohan and Raman, B. (1994). Hydrophobicity and chaperone like activity of γ -crystallin. *Investigative Ophthalmology and Visual Science (Supplement)*, 35: 1905.

48. Rao, K.S., Sirdeshmukh, R. and Gupta, P.D. (1994). Modulation of cytosolic RNase activity by endogenous RNase inhibitor in rat vaginal epithelial cells on estradiol administration. *FEBS Letters*, 343: 11-14.

49. Rao, S.C., Srinivas, V. and Balasubramanian, D. (1994). Conformational studies on γ -crystallin, the core protein of the bird eye lens. *Proceedings of Indian Academy of Sciences (Chemical Sciences)*, 106: 1399-1414.

50. Rao, S.H. and Sesikeran, B. (1994). Idiopathic congestive splenomegaly in Wistar rats. *Laboratory Animals*, 3: 117-120.

51. Rao, S.H. and Diwan, P.V. (1995). A behavioral profile of bilateral anophthalmic mutant rats. *Experimental Animals (Tokyo)*, 44: 67-69.

52. Ray, M.K., Kumar, G.S. and Shivaji, S. (1994). Phosphorylation of lipopolysaccharides in the Antarctic psychrotroph *Pseudomonas syringae*: a possible role in temperature adaptation. *Journal of Bacteriology*, 176: 4243-4249.

53. Ray, M.K., Kumar, G.S. and Shivaji, S. (1994). Tyrosine phosphorylation of a cytosolic protein from the Antarctic psychrotrophic bacterium *Pseudomonas syringae*. *FEMS Microbiology Letters*, 122: 49-54.

54. Ray, M.K., Kumar, G.S. and Shivaji, S. (1994). Phosphorylation of membrane proteins in response to temperature in an Antarctic *Pseudomonas syringae*. *Microbiology*, 140: 3217-3223.

55. Reddy, B.V.B. and Pandit, M.W. (1995). A statistical analytical approach to decipher information from biological sequences: application to murine splice-site analysis and prediction. *Journal of Biomolecular Structure and Dynamics*, 12: 0739-1102.

56. Reddy, G.S.N., Rajagopalan, G. and Shivaji, S. (1994). Thermolabile ribonucleases from Antarctic psychrotrophic bacteria: detection of the enzyme in various bacteria and purification from *Pseudo-*

monas fluorescens. *FEMS Microbiology Letters*, 122: 211-216.

57. Reddy, P.S. and Chatterji, D. (1994). Evidence for a pyrimidine-nucleotide-specific initiation site (the *i* site) on *Escherichia coli* RNA polymerase. Proximity relationship with the inhibitor binding domain. *European Journal of Biochemistry*, 225: 737-745.

58. Reddy, P.S., Raghavan, A. and Chatterji, D. (1995). Evidence for a ppGpp-binding site on *Escherichia coli* RNA polymerase: proximity relationship with the rifampicin-binding domain. *Molecular Microbiology*, 15: 255-265.

59. Renil, M., Nagaraj, R. and Pillai, V.N.R. (1994). Gel-phase peptide synthesis on a new high-capacity tetraethyleneglycol diacrylate-crosslinked polystyrene support: synthesis of pardaxin 16-33. *Tetrahedron*, 50: 6681-6688.

60. Revathi, C.J., Chattopadhyay, A. and Srinivas, U.K. (1994). Change in membrane organization induced by heat shock. *Biochemistry and Molecular Biology International*, 32: 941-950.

61. Saberwal, G., Thennarasu, S., Dhople, V.M., Jagannadham, M.V. and Nagaraj, R. (1994). Studies on the synthesis of the toxins, pardaxin, α -toxin and their analogues by solid-phase methods. *Proceedings of Indian Academy of Sciences (Chemical Sciences)*, 106: 1109-1121.

62. Saberwal, G. and Nagaraj, R. (1994). Cell-lytic and antibacterial peptides that act by perturbing the barrier function of membranes: facets of their conformational features, structure-function correlations and membrane-perturbing abilities. *Biochimica et Biophysica Acta*, 1197: 109-131.

63. Saran, S., Azhar, Md., Manogaran, P.S., Pande, G. and Nanjundiah, V. (1994). The level of sequestered calcium in vegetative amoebae of *Dictyostelium discoideum* is a predictor cell fate. *Differentiation*, 57: 163-169.

64. Sesikeran, B., Rao, S.H., Krishnamurthy, D. and Reddy, D.R. (1994). Studies on Sural nerve biopsies in endemic skeletal fluorosis. *Fluoride*, 27: 189-193.

65. Shalini, V.K., Luthra, M., Srinivas, L., Rao, S. H., Basti, S., Reddy, M. and Balasubramanian, D. (1994). Oxidative damage to the eye lens caused by cigarette smoke and fuel smoke condensates. *Indian*

Journal of Biochemistry and Biophysics, 31: 261-266.

66. Sinha, S. and Parthasarathy, S. (1994). Behaviour of simple population models under ecological processes. *Journal of Biosciences*, 19: 247-254.

67. Singh, L. and Majumdar, K.C. (1994). Behaviour of micro-chromosome associated satellite DNA in *Bungarus fasciatus* (Ophidia, Elapidae). *Journal of Genetics*, 73: 1-15.

68. Singh, L., Panicker, S.G., Nagaraj, R. and Majumdar, K.C. (1994). Banded krait minor-satellite (Bkm)-associated Y chromosome-specific repetitive DNA in mouse. *Nucleic Acids Research*, 22: 2289-2295.

69. Singh, L., Panicker, S.G., Nagaraj, R. and Majumdar, K.C. (1994). Functional significance of molecular organization of sex chromosomes. *Proceedings of Indian National Science Academy*, 5: 455-470.

70. Singh, L., Wadhwa, R., Naidu, S., Nagaraj, R. and Ganesan, M. (1994). Sex and tissue-specific Bkm (CAFA)-binding protein in the germ cells of heterogametic sex. *Journal of Biological Chemistry*, 269: 25321-25327.

71. Singh, S. and Gupta, P.D. (1994). Tampering with cytokeratin expression results in cell dysfunction. *Epithelial Cell Biology*, 3: 79-83.

72. Singh, S. and Gupta, P.D. (1994). Intermediate filaments - Heterogenous expression pattern and modulation: can their role in structure and function of the cell be ascertained? *Biology of the Cell*, 82: 1-10.

73. Singh, S., Koke, J.R., Gupta, P.D. and Malhotra, S.K. (1994). Multiple roles of intermediate filaments. *Cytobios*, 77: 41-57.

74. Sridhar, T.S., Rema, V., Swarup, G. and Khar, A. (1995). Deregulation of tyrosine kinases in a spontaneous macrophage tumour: ectopic expression of *lck*. *International Journal of Oncology*, 6: 487-492.

75. Srinivas, U.K. and Revathi, C.J. (1994). Altered expression of α -fetoprotein and albumin in early embryonic rat liver. *Biochemistry and Molecular Biology International*, 33: 21-28.

76. Thanaraj, T.A. (1994). Phylogenetically preserved inter-rRNA base pairs involvement in ribosomal subunit association. *Nucleic Acids Research*, 22: 3936-3942.

77. Tharun, S. and Sirdeshmukh, R. (1995). Specific endonucleolytic cleavages of mouse albumin mRNA and their modulation during liver development. *Nucleic Acids Research*, 23: 641-646.

78. Vijayalakshmi, V. and Gupta, P.D. (1994). Estradiol-regulated transamidation of keratins by vaginal epithelial cell trans-glutaminase. *Experimental Cell Research*, 214: 358-366.

In Press

1. Aggarwal, R.K., Singh, P. and Singh, L. Genetic fingerprinting: an overview with special reference to its application in agriculture. In *Proceedings of the Golden Jubilee Symposium on Genetic Research and Education: Current Trends and Next Fifty Years*.

2. Chatterji, D. and Gopal, V. Fluorescence spectroscopy analysis of active and regulatory nucleotide binding site to *E. coli* RNA polymerase. *RNA polymerase and associated factors* (ed. Sankar Adhya). *Methods in Enzymology*, Academic Press, N.Y.

3. Chattopadhyay, M.K., Devi, U.K., Gopishankar, Y. and Shivaji, S. Thermolabile alkaline phosphatase from *Sphingobacterium antarcticus*, a psychrotrophic bacterium from Antarctica. *Polar Biology*.

4. Das, K., Sarkar, N., Das, S., Bhatlacharya, K. and Balasubramanian, D. Fluorescence monitoring of the hydrophobic surface of dextrin using *p*-toluidinonaphthalenesulfonate. *Langmuir*.

5. Dhople, V.M. and Nagaraj, R. Generation of analogs having potent antimicrobial and hemolytic activities with minimal changes from an inactive 16-residue peptide corresponding to the helical region of *Staphylococcus aureus* -toxin. *Protein Engineering*.

6. Feng, G., Deak, P., Kasbekar, D.P., Gil, D.W. and Hall, L. Cytogenic and molecular localization of *tipE*: a gene affecting sodium channels in *Drosophila melanogaster*. *Genetics*.

7. Gowrishankar, J. and Manna, D. How is osmotic regulation of transcription of the *Escherichia coli* *proU* operon achieved? A review and a model. *Genetica*.

8. Hegde, S.P., John Bright, J., Kausalya, S. and Khar, A. AK-5 tumor-induced expression of interleukin-12: role of IL-12 in NK-mediated AK-5 regression. *Cellular Immunology*.

9. Jain, N., Sudhakar, Ch. and Das, M.R. Cell free ascitic fluid prevents loss of cell surface sialic acid from Zajdela Ascitic Hepatoma cells in culture. *Indian Journal of Biochemistry and Biophysics*.

10. John Bright, J., Kausalya, S. and Khar, A. Natural killer cell activation associated induction of target cell DNA fragmentation in a spontaneously regressing macrophage tumour. *Immunology*.

11. Kausalya, S., Varalakshmi, Ch. and Khar, A. Correlation of *in vitro* and *in vivo* effects of IFN- with the spontaneous regression of a rat histiocytoma. *Journal of Interferon Research*.

12. Khar, A., Pardhasaradhi, B.V.V., Varalakshmi, Ch., Ali, A.M. and Manogaran, P.S. Apoptosis: the *in vivo* mechanism which mediates spontaneous AK-5 tumour regression. *Immunology Letters*.

13. Luciano, L., Gupta, P.D., Groos, S. and Adamski, J. Modulation of apoptosis by starvation: morphological and biochemical study of rat intestinal mucosa. *Cell Death and Differentiation*.

14. Manogaran, P.S., Kausalya, S. and Pande, G. Flow-cytometric measurements of NK-cell immuno-conjugates by pulse width processing. *Cytometry*.

15. Mukherjee, S. and Chattopadhyay, A. Wavelength-Selective Fluorescence as a novel tool to study organization and dynamics in complex biological systems. In *New probes for structure and dynamics* (eds. D.J.S. Birch and A.P. Demchenko), *Journal of Fluorescence (special issue)*.

16. Nagaraju, J.G., Sharma, A., Sethuraman, B.N., Rao, G.V. and Singh, L. DNA fingerprinting in silkworm *Bombyx mori* using Bkm-derived probe. *Proceedings of the Third International Conference on DNA Fingerprinting*.

17. Parthasarathy, S. and Sinha, S. Controlling chaos in unidimensional maps using constant feedback. *Physical Review E*.

18. Rachel, A.J., Rahman, R., Chandrasekharappa, S., Evans, G. and Srivatsan, E.S. Rearrangement and translocation of chromosome 11q13 sequences in cervical carcinoma cell lines. *American Journal of Human Genetics*.

19. Ramakrishnan, M., Prathiba, V., Rao, K.S., Babu, M. and Gupta, P.D. Expression of keratin in post burn scars and keloids. *Annals of Mediterranean Burns Club*.

20. Rao, Ch. Mohan, Qin, C., Robinson, W.G. and Zigler, J.S. Effect of smoke

condensate on the physiological integrity and morphology of organ cultured rat lenses. *Current Eye Research*.

21. Roy, J.K., Majumdar, K.C., Pathak, S. and Khar, A. Multiple specific chromosomal alterations in a rat ascitic histiocytoma 'AK-5'. *Anticancer Research*.

22. Saravanan, P. and Gupta, P.D. Image analysis in Cell Biology. In *Advances in Pathology* (ed. K. S. Ratnakar), Jaypee Publishers, New Delhi.

23. Sengupta, S., Prasanna, T.B. and Kasbekar, D.P. Sterol 14, 15 reductase (erg3) mutations switch the phenotype of *Neurospora crassa* from sensitivity to the tomato saponin-tomatine to sensitivity to the pea phytoalexin pisatin. *Fungal Genetics Newsletter*.

24. Sharma, Y. and Balasubramanian, D. Crystallins. In *Guide Book to Calcium-Binding Proteins* (ed. M.R. Celio), Oxford University Press.

25. Sharma, Y. and Balasubramanian, D. Calcium-binding properties of crystallins. *Ophthalmic Research*.

26. Shivaji, S., Ahmad, M.B. and Rao, K.M. Synthesis and secretion of proteins by the human proliferative, secretory, decidual and hyperplastic endometrium. *Cellular and Molecular Biology*.

27. Shivaji, S., Devi, L.G. and Sundaram, C.S. ³¹P NMR study of phosphorus containing metabolites in the uterus of hamster: changes during the estrous cycle and the effect of hormonal manipulation. *Journal of Steroid Biochemistry and Molecular Biology*.

28. Shivaji, S., Peedicayil, J. and Devi, L.G. Analysis of the motility parameters of *in vitro* hyper-activated hamster spermatozoa. *Molecular Reproduction and Development*.

29. Singh, L. Biological significance of minisatellites. *Proceedings of the Third International Conference on DNA Fingerprinting*.

30. Singh, L. and Rajyashri, K.R. Molecular basis of sex determination and differentiation in mammals. *Proceedings of the Symposium on Molecular Genetics and Gene Therapy*.

31. Singh, S. and Gupta, P.D. Electron microscopy of chromosome. In *Chromosome* (ed. R.C. Sobti).

32. Sitaram, N. and Nagaraj, R. Seminalplasmin. *Bioessays*. □

Workshop

Science and Technology Development Strategies in India and China

A joint workshop on "Science and Technology Development Strategies in India and China" was organized by National Institute for Science Technology & Development Studies (NISTADS), New Delhi, on 25-26 September 1995, in association with Central South University of Technology (CSUT), Changsha, China, under CSIR-NSFC Agreement. The objective of the workshop was to have a discussion on the report of the bilateral project on "A Comparative Study of Science and Technology Development Strategies in India and China" and to throw light on the issues related to science, technology and society in these countries. About 35 scholars both from China and India participated in the workshop.

The workshop was inaugurated by Prof. M.G.K. Menon, Member of Parliament (Rajyasabha). While welcoming the delegates Dr Ashok Jain, Director, NISTADS, briefly outlined the genesis of the bilateral project and its main objectives. He said that both India and China have had about 50 years of experience in linking science and technology to development, and these countries have been in a distinctly different class as compared with other developing countries. It is therefore important to share our experiences and it is for this purpose that this workshop was organized. Prof. Chen Xiaotian, the Head of the Chinese delegation, pointed out that both India and China have made substantial progress in introducing reforms in science and technology. He expected that this

bilateral project would lead to more exchanges and interactions between the two countries. Prof. Chen Wenhua, the project leader on the Chinese side, pointed out that China and India have to play a major role in global S&T and in this context cooperation between them is essential to learn from each other and to complement each other's work. In planning further policy research work, it is important to combine theory and practice and to learn from history for drawing lessons for the future. Prof. Dong Jinsheng, Counsellor, Science and Technology, Chinese Embassy in India, pointed out that the on-going process of reforms in China and India since 1980s has made it necessary to undertake comparative studies for benchmarking the progress and delineating areas of common interest.

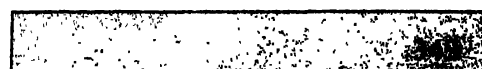
In his keynote address, Prof. M.G.K. Menon emphasized the need for greater interaction of science and technology with society. The progress in science, technology and development no longer follows a linear model but these have an intricate relationship with society. Science does not stand alone but it is deeply embedded in the fabric of the society for its progress and dissemination.

One could learn considerably from the experience of the two countries in science and technology as well as from their historical past. However, to plan for the future, one has to look into the present socio-political needs.

China and India began their development process at about the same time, Dr Menon remarked. At the time of Independence, Indian science, by and large, was in a more advantageous position. It was of comparable international standards but was divorced from the production process. At the same time China had been a battle ground for different colonial forces and suffered severe physical damage. However, in spite of this, China has been able to make considerable achievements with a coherent vision and tremendous self-confidence which has been less evident in India. Indian science has been fortunate in having a very supportive political attitude from the time of Jawahar Lal Nehru onwards. In the context of present world scenario of liberalization, he cautioned against the multinationals which have become global entities and are stronger than governments. Also, the challenges of the Intellectual Prop-



Dr Ashok Jain, Director, NISTADS, welcoming the delegates to the workshop on 'Science and Technology Development Strategies in India and China'



erty Rights (IPR) are especially acute particularly the attempts to block patents in almost every major area. Dr Menon stressed the need for greater cooperation between India, China and Japan, to prevent domination of other countries and to provide a more just World Order.

The deliberations of the workshop were spread over four technical sessions. Some of the important suggestions made during the workshop for incorporation in the Joint Report are: (1) In both the countries reforms in the economic system and in the R & D system are being carried out simultaneously to have a synergetic impact on technology development. This needs to be illustrated in an integrated form. Basic differences and the lessons to be learnt may be highlighted from the experiences in India and China; (2) Looking at the needs of the 21st century, science and technology strategies and policies should be oriented towards coordination between science, technology and the economy for faster growth and sustainability. The concept of environment friendly technologies should be

built up in the future development approach; (3) The report should bring out Economy-Technology-Science (E-T-S) model approach keeping in view the present paradigm of technology and economic growth; (4) Self-reliance and import substitution as the basic conditions in India and China should be highlighted with case studies. Effectiveness in implementation of the various plans formulated over the years need to be reflected. Policy recommendations may be given separately for each country; (5) A section on IPR could be included; (6) Based on the historical experience of harnessing science and technology for the benefit of society a future development model should emerge for India and/or China; and (7) Possible areas of future cooperation between India and China need to be strengthened. □

Bell Metal Production using Raw Coal

A workshop and demonstration of 'Bell Metal Production Using Raw Coal' was organized



Shri Niranjan Pattnaik, Minister of Industries, Orissa, in discussion with artisans, RRL scientists and government officials during the workshop on 'Production of Bell Metal Utensils using Raw Coal'

from 28 August 1995 to 6 September 1995 at Balakati, Khurda district, Orissa. It was jointly organized by Regional Research Laboratory (RRL), Bhubaneswar; National Institute of Science, Technology & Development Studies, Bankura Field Station; Directorate of Handicrafts & Cottage Industries, Government of Orissa, Bhubaneswar, and Orissa State Co-operative Handicrafts Corporation Ltd., Bhubaneswar, and conducted by RRL, Bhubaneswar, and Directorate of Handicrafts & Cottage Industries, Government of Orissa. 70 artisans from different parts of Orissa such as Kantilo, Baichuan, Rathijema, Muktapur, Kolimati, Dhananjayapur, Pitatangara, Aukhama, Bhatimunda, Mancheswar and Balakati participated in the workshop and underwent the training for production of bell metal and brass using coal.

The objective of the workshop and demonstration was to replace the wood charcoal by raw coal in both melting and forging processes of brass and bell metal cottage industries. Presently, about 30,000 artisans of Orissa are engaged in production of brass and bell metal utensils. Almost everybody is using wood charcoal for melting as well as heating and beating (forging) of metal for the production of various kinds of utensils and handicrafts. The average consumption of charcoal is about 2 kg for production of 1 kg metal. The artisans of Orissa always work in team or group which comprises 6 to 10 persons in a cottage industry. The team consumes about 50 to 60 kg of charcoal and produces 20 to 30 kg of metal utensils in a day. Presently the industry run for 60 to 90 days in a year in Orissa. The reason for less number of working days are many, such as poor supply and high cost of raw materials, charcoal and less con-

sumer's demand. However, the most widely consumed material in these industries is wood charcoal, whose average cost is Rs 5 per kg in Orissa except in forest areas. The attempt has been made by Regional Research Laboratory, Bhubaneswar, to use raw coal instead of charcoal for both melting and forging processes of brass and bell metal cottage industries during the workshop.

The artisans from West Bengal gave a demonstration of the process of production of bell metal and brass utensils with coal on the first day of the workshop. Local artisans of Orissa picked up the process immediately without any difficulties. However, the local artisans expressed their difficulties for the production of utensils by using the tools of the artisans of Bengal. The artisans fabricated plate (*thali*), saucer (*thalia*), cup, tray, bowl, etc., out of bell metal using raw coal. The quality and the finish of the bell metal was found similar to that made by charcoal. The brass works were mostly carried out by the artisans of Mancheswar and Kantilo (Handicraft Corporation). They prepared the brass alloy from copper and zinc, melted the brass and cast the same for preparation of brass handicrafts of different sections and designs.

The production of different articles of both bell metal and brass works were carried out in the local work places (*sala*) of Rathijema and Baichuan villages by the local artisans using their traditional tools and charcoal furnaces during 2nd batch of the training. Different types of bell metal such as *ghanta*, *thali*, bowl and brass pitcher were fabricated by the artisans using raw coal. The finish and quality of fabrication were found to be satisfactory. However, the following observations were made by the artisans during the ten day demon-

stration: (1) Most of the artisans complained about the emission of smoke during burning of coal; (2) They wanted a fixture, such as chimney, to expel the smoke from the workplace; (3) Some artisans said that heating of the ingots and plates during beating process (forging) is slow when more than five pieces of metal plates are sandwiched; (4) The rate of rise of temperature of the metal plates during heating retarded after one hour of the operation; and (5) All artisans agreed that both melting and forging of brass and bell metals is possible by using raw coal and the fabrication process is commercially viable.

Observations made by RRL scientists during the workshop are as follows: (1) Using traditional tools and furnaces, the consumption of A/B grade coal (ash content 13%) is about 1 kg for melting and beating of 1 kg Bell metal, whereas 2 kg of charcoal is consumed for 1 kg of metal; (2) The melting and beating process by coal is found to be easy and similar to that of charcoal; (3) Heat is maintained in the furnace for a larger period when raw coal is used, whereas in case of charcoal, fire in the hearth extinguishes soon and needs continuous air blowing; (4) The sintered ash of the coal choked the grate of the fur-

nace partially during heating and beating process, whereas it was not found so in traditional furnace as the ash of the charcoal is always blown out of the furnace with hot air during use of charcoal; (5) Unlike the traditional charcoal furnace, there were no suspended carbon and ash particles in the vicinity of the workplace; (6) The workers get accustomed with the smoke in due course; otherwise a chimney should be provided in each work place; and (7) All trainees have demanded for a proper supply of A/B grade coal to their village at a fair price.

Some suggestions offered during the workshop are: (i) Similar type of workshop and demonstration should be conducted in different places of Orissa; (ii) A new furnace with ash disposal system should be designed exclusively for burning of raw coal; and (iii) A group of artisans should be engaged during the development of a coal furnace and R & D should continue till the artisans are satisfied.

The workshop ended on 6 September 1995. Certificates were distributed to all the participants by Shri T. Mohanty, Joint Director, H & CI, Government of Orissa. □

Training Course

Intensive Course on Molecular Modelling

AN intensive course on 'Molecular modelling: Drug design and biomolecular systems' was organized by the CSIR Centre for Mathematical Modelling and Computer Simulation (C-MMACS), Bangalore, during 9-13 October 1995. The course was con-

ducted by Prof. W.F. van Gunsteren, a renowned Swiss expert on the subject. Prof. Gunsteren was assisted by his colleague, Mr Walter R.P. Scott. Invited lectures were also delivered by Prof. P. Balaram of the Indian Institute of Science (IISc.), Bangalore, and Dr Anneliese Palmer of Biosym

Technologies, Australia. 30 participants drawn from the drug industry, R&D establishments and academic institutions attended the course sponsored by CSIR and supported by Tata Elxsi (India) Ltd., DCM Data System Ltd, Sun Microsystems Intercontinental Operations and S.K. International.

The intensive course was inaugurated by Dr K. N. Raju, Director, National Aerospace Laboratories, Bangalore. In his brief inaugural speech Dr Raju explained why designing molecules is of great strategic interest and said that if we don't keep up with new technologies it would be tantamount to committing commercial suicide. Earlier, Prof. V.K. Gaur, CSIR Distinguished Scientist, welcoming the participants and guests, said that biomolecular design has opened up a new era of human endeavour.

Prof. P. Balaram, Chairman, Molecular Biophysics Unit, IISc, delivered a fascinating lead lecture on "Serendipity and Rationality in Drug Design". Explaining that most of the early drugs were the outcome of serendipity, Prof. Balaram pointed out that there now exists a rational approach to drug design which consists of identifying the sites for drug action and targetting the right receptors and enzymes. However, he warned that rational drug design was very expensive and full of pitfalls. "There is still a great gulf between research and practice in drug design and it is much easier to achieve scientific success than to reach the clinic", he said. The success of the course owed much to the assiduous efforts of Dr M.W. Pandit and his colleagues of C-MMACS.

Nominations Invited

CSIR Young Scientist Awards for 1996

NOMINATIONS are invited by the Council of Scientific and Industrial Research (CSIR) for the 1996 CSIR Young Scientist Awards. The awards are given for research contributions made primarily in India during the past five years. The age of nominees should not be more than 35 years as on 26 September 1995. Regular employees (scientists) working in CSIR system are eligible.

The awards, each of the value of Rs 25,000 (Rupees twenty five thousand only) are given annually in the following disciplines: (1) Physical Sciences (including Instrumentation), (2) Chemical Sciences, (3) Biological Sciences, (4) Engineering Sciences and (5) Earth, Atmosphere, Ocean and Planetary Sciences.

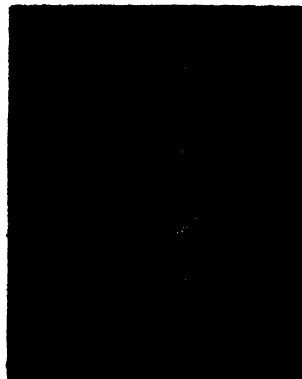
Nominations should be sent by 31 December 1995 as per the prescribed proforma (20 copies) along with one set of reprints of research papers published during last 5 years to the Head, Human Resource Development Group, Elemental Research Division, Council of Scientific & Industrial Research, CSIR Complex, Pusa, New Delhi 110 012. The proforma for nomination may be obtained from the above address.

Important: Kindly note that nominations of scientists for the earlier years are no longer valid for consideration for the 1996 CSIR Young Scientist Awards. Only fresh nominations are valid.

Honours and Awards

Hem Shanker Ray

THE Institute of Engineers (India), Orissa State Centre, has awarded the Govinda Gupta Memorial Running Shield to Prof. Hem Shanker Ray,



Director, RRL-Bhubaneswar, for his outstanding contributions in the field of R & D activity. This shield was presented to Prof. Ray during the 28th Engineers' Day Celebration on 15 September 1995.

Prof. Ray is also a recipient of Kamani Gold Metal (awarded by Indian Institute of Metals for best paper published in 1978 in *Transactions Indian Institute of Metals*); National Metallurgist Day Award given by Ministry of Steel & Mines, Government of India, in 1984; Silver Jubilee Research Award of IIT, Kharagpur, 1988 and G.D. Birla Award of Indian Institute of Metals, Ranchi, in 1991.

Printed and Published by Dr G.P. Phondke, Director, Publications & Information Directorate (PID), Dr K.S. Krishnan Marg, New Delhi - 110 012
Printed at PID Printing Unit

Editors : Dr B.C. Kashyap, Dilip M. Sahni and Madhu Sahni
Phone: 5786301 Gram: PUBLIFORM

Production : Kaushal Kishore
Telex: 031-77271
RN 4512/57

Annual Subscription: Rs. 3000
Single Copy: Rs. 300
E-mail: pid@srineta.com
Fax: 5786301

